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The purpose of this study was to develop and implement a two-year mathematics laboratory program for ninth-grade low achievers. The laboratory program was designed to raise the mathematics skills of a selected group of low-achieving ninth graders at Washington High School, a rural urban school in the South Bend Community School Corporation, South Bend, Indiana. The objectives for each of the participating students sought to: increase the students' grade equivalent scores in computation skills, concept skills, problem solving skills, and total skills, and improve the students' attendance in mathematics by 15%. Comparisons of the Metropolitan Mathematics Achievement pre- and post-test scores and attendance reports revealed that each objective was met by 85.7% to 100% of the participants. The practicum treatment for the program was considered to be successful. (Author)

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THE DEVELOPMENT AND IMPLEMENTATION OF A TWO-YEAR MATHEMATICS LABORATORY PROGRAM FOR NINTH GRADE LOW ACHIEVERS

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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by James A. Cohen[1]

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A report on a mathematics program that was developed and implemented at Washington High School, South Bend, Indiana

SE 034 211

Two-Year Individual Practicum

Submitted: May 8, 1979

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TITLE The Development and Implementation of a Two-Year Mathematics Laboratory Program for Ninth Grade Low Achievers

DESCRIPTORS Doctoral Theses: Educational Research; Achievers; Activity Learning; Secondary Education; Secondary School Mathematics; Teaching Methods; Laboratories; Low Achievers Individualized Instruction

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Dedication

to my wife

SHARON K. COHEN

and my son

JAMES A. COHEN II

ACKNOWLEDGEMENTS

The practitioner considers it a privilege to acknowledge several people whose contributions and support made this practicum possible:

Mr. Sam Kaylin, who served not only as the practicum reviewer, but also provided considerateness and guidance.

Mrs. Sharon Cohen, my wife, who gave freely of her time and expertise in proofreading and typing this practicum.

Mr. Robert Million, the Principal of Washington High School, who cooperated fully in the development and implementation of this practicum.

CHAPTER I

INTRODUCTION

In the innovations of educational activities during the last two decades, much effort has been directed toward the improvement of mathematics in the high school. This was evidenced by the many new programs and instructional materials that appeared during this period of time. The emphasis and attention was directed mainly toward the above average mathematics achiever, the college-bound student. Relatively little attention has been devoted to the needs of other types of students, especially the ones often referred to as low achievers, those students who for various reasons—mental, emotional or social immaturity, physical or psychological deficiencies, or limited cultural or educational experience—rank below the thirtieth percentile of the student population in mathematics achievement.[2]

The mathematical needs of the low achiever can no longer be ignored. This was made quite clear by Beckman when he referred to the "crisis" in the mathematics education of the low achiever and described some of the ways in which this crisis can be expressed:

> in personal terms: eyes filled with fear or boredom, families frustrated or completely uninterested, a collapse of self-respect;

---

[2] D. A. Johnson and G. R. Rising, Guidelines for Teaching Mathematics (Belmont, CA: Wadsworth Publishing Company, 1967), p. 191.

> in statistical terms: half of all ninth graders taking mathematics, or two million children in this one grade, enrolled in general mathematics classes;
>
> in economic terms: a nation handicapped by millions of mathematically illiterate adults when two-thirds of all skilled and semiskilled job opportunities are already closed to the mathematically incompetent and when technological change is demanding more and more mathematics of the average citizen every day;
>
> in social terms: thousands of families bound to generations of poverty by a chain of events (divided homes, poor health, discrimination, lack of motivation) in which scholastic failure is perhaps the link most accessible to efforts to help the poor break free;
>
> in political terms: cities disrupted by the rebellion of some of the same young men who slept through their classes a few years ago.[3]

These statements make clear the need to provide adequate mathematics instruction to meet the needs of the low achiever. What instructional design should be used for this purpose? The answer to this need may lie in an individualized laboratory approach. Some educators have indicated the suitability of this approach for the low achiever because of the particular characteristics of this type of student.

Fehr indicated that for the low achiever the means of teaching and selection of subject matter must interest and motivate learning. Because of their previous continued failure in mathematics, low achievers are generally frightened and inhibited by the ordinary presentation of mathematics. This attitude can be changed by building self-respect through permitting initial success with simple material and by giving everyday practical applications. Fehr states further that:

> . . . the low achiever has difficulty in forming associations with words and ideas, he cannot readily generalize from a

---

[3] M. W. Beckman, "Teaching the Low Achiever in Mathematics," The Mathematics Teacher 62 (April, 1969):443.

> series of experiences, his memory is not strong, he has little taste for the abstract, . . . he learns best by starting with concrete, physical situations.[4]

In view of the above, the mathematics laboratory appeared to be a promising instructional approach for low achievers. Yet despite the claims for its possibilities, little research has been conducted to evaluate it as an instructional method for low achievers, particularly at the high school level. There was, then, a challenge for the practitioner to determine the extent to which low achieving ninth graders could benefit from individualized mathematics instruction in a laboratory setting; the practitioner welcomed this challenge.

---

[4]H. F. Fehr, Teaching High School Mathematics (Washington, DC: National Education Association, 1955), p. 14.

CHAPTER II

IDENTIFYING THE PROBLEM AND ASSESSING THE NEED

Description of the School

The practitioner is an assistant principal charged with the responsibility of curriculum development at Washington High School, a rural urban school of fifteen hundred students in South Bend, Indiana. Seventy percent of the students are white; thirty percent, black and Mexican American. Many of the Mexican Americans are sons/daughters of migrant workers. Consequently, some students are transit. The school is composed of grades nine through twelve. It is one of two high schools in the corporation with this composition. The other high schools enroll grades ten through twelve. Investigation of students' records and teacher grade analysis revealed that for the past three years approximately one-half (three hundred) of the students enrolled in high school mathematics experienced failure during the first semester.

The school administrators developed a program to attempt to deal with the problem. A volunteer teacher tutorial program was organized in September, 1976. The program was designed for those students who were deficient in mathematics skills. The program required that the students who needed and desired assistance meet with a tutor at 7:30 a.m. for 30-minute sessions on Thursdays and Fridays. The tutors consisted of five volunteer mathematics teachers.

The volunteer teacher tutorial program did not meet the needs of the students. Most students that needed the assistance, based on their test scores and classroom performance, did not attend the tutorial sessions. Daily bulletins and bulletin board notices advertising the program did not attract students in significant numbers to assist in solving the problem.

It was obvious to the practitioner that the tutorial program was not reaching or meeting the needs of those students for whom the program was designed. Consequently, the mathematics tutorial program did not increase the number of students passing high school mathematics.

The practitioner's research revealed that ninety percent of the students experiencing failure had scored below the ninth grade level on the Metropolitan Mathematics Achievement Test. Teacher referrals also revealed that these students were encountering mathematics skills problems.

Needs Assessment Data

In March, 1977, at the request of the practitioner, the Metropolitan Mathematics Achievement Test was administered to three hundred and sixty eighth grade students in the feeder schools. The students had recorded I.Q.'s of 80 - 111. Analysis of the Metropolitan Mathematics Achievement Test results indicated that eighty-one of the potential ninth graders were performing below the eighth grade level. The grade equivalent scores for seventy-five of these students in computation skills, concept skills, problem solving skills, and total scores are found in Appendix A, Table 2, Pages 82-83.

Eighty-one of the three hundred and sixty eighth grade students in the feeder schools scored in a grade equivalent range of 3.6 to 7.7

grade levels for total skills tested on the Metropolitan Mathematics Achievement Test. Investigation of students' records revealed that seventy-six of these students had received a grade of F in arithmetic. The pre-test total skills grade equivalent range for seventy-five of the potential ninth graders is found in Appendix A, Table 1, Page 81.

Further investigation of the potential ninth grade students' records revealed that student attendance in mathematics was poor. The eighth grade teachers who were interviewed agreed that the lack of adequate mathematics skills was a major contributor to the poor attendance recorded in mathematics. The mathematics period absences are found in Appendix A, Table 2, Pages 82-83.

These conditions existed at a time when there was widespread demands confronting all levels of education to get back to the 3 R's, back to basics: especially the basics of reading, writing, and arithmetic. The conditions at Washington High School certainly indicated a need to improve the teaching of mathematics to the low achieving ninth graders. The local newspaper indicated that many of our students were leaving high school and could not write a check or balance a checkbook adequately. Poor student performance on standardized tests, in college courses, and on the job, along with parent complaints supported the seriousness and widespread nature of the problem. This practitioner decided to begin the search for alternatives to solve the problem.

Teacher Observations

Teacher observations played an important role in identifying and evaluating students' mathematics deficiencies. The eighth grade mathematics teachers interviewed in the feeder schools indicated that

from their observations for several years more than twenty percent of the eighth graders had been experiencing basic mathematics skills deficiencies and performed at one or more grade equivalents below grade level. Mathematics teachers at Washington High School confirmed the skills deficiencies observed by the feeder school teachers. However, the Washington High School teachers indicated that at least twenty-five percent of the freshmen had mathematics skills deficiencies. This allowed for little if any success in basic high school mathematics.

Statement of the Problem

After considering all the data and other observational input, the practitioner met with the high school principal to search for alternatives. The practitioner suggested that an individualized mathematics laboratory program might offer the best solution to the problem of improving the mathematics skills of the ninth grade low achievers—thus, increasing the achievement levels of the ninth grade low achievers.

CHAPTER III

CONCEPTUALIZING A SOLUTION

The practitioner scheduled a meeting with the school principal and the director of secondary education in July, 1977. The practitioner proposed "The Development and Implementation of a Two-Year Mathematics Laboratory Program for Ninth Grade Low Achievers." The proposal was accepted, and the practicum was scheduled to begin on September 6, 1977, and end January 26, 1979. The emphasis of the program was on an Individualized Mathematics Laboratory System (IMLS). The Individualized Mathematics Laboratory System (IMLS) was composed of portions of the materials and activities from the Ginn Individualized Mathematics System, the Holt Individualized Computational Skills Series, and teacher developed activities and exercises based on the results of the needs assessment and a review of studies of other mathematics laboratory programs.

The outcome objectives were developed, based on each student's I.Q. and his/her recorded entry skills data. The expectations were predicted, based on the recorded skills for each student in each of the four skills categories and his/her ability to succeed in those areas as indicated by his/her recorded I.Q.; e.g., students with the higher skills and more ability were expected to achieve more than students with lower skills and less ability.

An achievement scale was used to develop the objectives. The scale was developed, based on the theory that the normal growth of student achievement is one month of achievement for each month of instruction. The practitioner developed the scale, based on the fact that all the students were below grade level and had varied ranges of skill levels and recorded I.Q. scores. The achievement scale is found below.

Achievement Scale

Pre-Test Score	I.Q. Range	Expected Years Achievement	
		First Year	Second Year
3.6-5.5	80-90	.70	.35
3.6-5.5	91-101	.80	.40
3.6-5.5	102-112	.90	.45
5.6-7.5	80-90	.80	.40
5.6-7.5	91-101	.90	.45
5.6-7.5	102-112	1.00	.50
7.6-9.5	80-90	.90	.45
7.6-9.5	91-101	1.00	.50
7.6-9.5	102-112	1.10	.55

Outcome Objectives for the First Year

The objectives of the Individualized Mathematics Laboratory System (IMLS) for each student during the first year are listed on the following pages:

1. Computational skills grade equivalent scores of identified students will increase from pre-test scores listed to expected post-test scores listed, based on the Metropolitan Mathematics Achievement Test:

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score
1-1	1	81	3.6	4.3
1-2	1	101	3.6	4.4
1-3	1	108	3.6	4.5
1-4	1	83	4.1	4.8
1-5	2	95, 101	4.3	5.1
1-6	2	106, 106	4.3	5.2
1-7	2	81, 89	4.6	5.3
1-8	2	96, 97	4.6	5.4
1-9	3	103, 104, 105	4.6	5.5
1-10	2	81, 85	4.8	5.5
1-11	1	101	5.0	5.8
1-12	1	108	5.0	5.9
1-13	1	109	5.1	6.0
1-14	4	106, 108, 110, 111	5.3	6.2
1-15	4	102, 103, 107, 107	5.5	6.4
1-16	1	84	5.7	6.5
1-17	4	97, 97, 101, 101	5.7	6.6
1-18	5	103, 103, 104, 104, 109	5.7	6.7
1-19	1	86	6.0	6.8
1-20	1	101	6.0	6.9
1-21	3	106, 107, 110	6.0	7.0
1-22	1	111	6.1	7.1
1-23	3	98, 100, 101	6.2	7.1
1-24	6	103, 105, 106, 107, 109, 109	6.2	7.2
1-25	1	86	6.5	7.3
1-26	1	91	6.5	7.4
1-27	2	105, 109	6.5	7.5

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score
1-28	2	86, 89	6.7	7.5
1-29	2	93, 98	6.7	7.6
1-30	4	102, 104, 108, 108	6.7	7.7
1-31	1	106	6.8	7.8
1-32	1	83	6.9	7.7
1-33	3	103, 110, 111	6.9	7.9
1-34	3	103, 105, 109	7.1	8.1
1-35	1	107	7.7	8.8
1-36	1	110	7.9	9.0

2. Concept skills grade equivalent scores of identified students will increase from pre-test scores listed to expected post-test scores listed, based on the Metropolitan Mathematics Achievement Test:

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score
2-1	1	101	3.6	4.4
2-2	1	108	3.6	4.5
2-3	1	97	3.7	4.5
2-4	2	89, 89	3.8	4.5
2-5	2	96, 98	3.8	4.6
2-6	1	83	4.0	4.7
2-7	1	102	4.0	4.9
2-8	1	86	4.2	4.9
2-9	1	101	4.2	5.0
2-10	4	103, 105, 107, 106	4.2	5.1
2-11	1	81	4.4	5.1
2-12	2	95, 100	4.4	5.2
2-13	4	108, 108, 109, 110	4.4	5.3
2-14	1	103	4.6	5.5
2-15	2	81, 86	4.7	5.4
2-16	1	98	4.7	5.5
2-17	5	103, 104, 110, 106, 109	4.7	5.6

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score
2-18	1	93	4.8	5.6
2-19	7	107, 105, 104, 107, 102, 103, 106	4.8	5.7
2-20	2	101, 101	5.1	5.9
2-21	3	103, 108, 110	5.1	6.0
2-22	1	84	5.3	6.0
2-23	3	97, 101, 101	5.3	6.1
2-24	3	107, 107, 109	5.3	6.2
2-25	3	105, 106, 109	5.6	6.6
2-26	2	81, 85	5.7	6.5
2-27	1	106	5.7	6.7
2-28	1	83	6.1	6.9
2-29	1	91	6.1	7.0
2-30	3	106, 108, 109	6.1	7.1
2-31	1	97	6.3	7.2
2-32	2	103, 111	6.3	7.3
2-33	1	86	6.5	7.3
2-34	2	111, 104	6.5	7.5
2-35	1	98	7.3	8.2
2-36	2	105, 109	7.3	8.3
2-37	1	110	7.5	8.5
2-38	1	111	7.7	8.8
2-39	2	104, 103	7.9	9.0

3. Problem solving skills grade equivalent scores of identified students will increase from pre-test scores listed to expected post-test scores listed, based on the Metropolitan Mathematics Achievement Test:

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score
3-1	2	84, 89	3.6	4.3
3-2	5	95, 96, 97, 101, 101	3.6	4.4
3-3	4	102, 104, 106, 108	3.6	4.5

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score
3-4	1	97	3.8	4.6
3-5	3	81, 83, 86	4.0	4.7
3-6	2	104, 105	4.0	4.9
3-7	1	81	4.3	5.0
3-8	1	98	4.3	5.1
3-9	6	105, 105, 106, 107, 108, 108	4.3	5.2
3-10	1	97	4.6	5.4
3-11	4	102, 103, 106, 110	4.6	5.5
3-12	1	104	4.8	5.7
3-13	2	83, 86	5.1	5.8
3-14	1	98	5.1	5.9
3-15	5	103, 103, 104, 107, 110	5.1	6.0
3-16	1	101	5.3	6.1
3-17	2	86, 89	5.4	6.1
3-18	1	98	5.4	6.2
3-19	3	103, 105, 108	5.4	6.3
3-20	2	103, 110	5.5	6.4
3-21	2	101, 101	5.6	6.5
3-22	2	103, 111	5.6	6.6
3-23	2	81, 85	6.0	6.8
3-24	1	100	6.0	6.9
3-25	9	103, 106, 107, 107, 108, 109, 109, 111, 111	6.0	7.0
3-26	1	91	6.2	7.1
3-27	1	106	6.2	7.2
3-28	2	107, 109	6.3	7.3
3-29	2	93, 101	6.5	7.4
3-30	2	106, 109	6.5	7.5
3-31	2	109, 110	6.8	7.8
3-32	1	109	7.7	8.8

4. Total skills grade equivalent scores of identified students will increase from pre-test scores listed to expected post-test scores

listed, based on the Metropolitan Mathematics Achievement Test:

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score
4-1	2	81, 81	3.6	4.3
4-2	1	108	3.6	4.5
4-3	1	89	3.7	4.4
4-4	2	96, 97	3.7	4.5
4-5	1	108	4.0	4.9
4-6	1	83	4.2	4.9
4-7	1	98	4.2	5.0
4-8	1	106	4.2	5.1
4-9	1	81	4.3	5.0
4-10	1	104	4.3	5.2
4-11	1	101	4.5	5.3
4-12	2	105, 106	4.5	5.4
4-13	1	101	4.6	5.4
4-14	2	103, 107	4.6	5.5
4-15	1	102	4.7	5.6
4-16	2	106, 107	4.8	5.7
4-17	1	101	4.9	5.7
4-18	2	105, 108	4.9	5.8
4-19	1	84	5.1	5.8
4-20	2	97, 101	5.1	5.9
4-21	2	86, 86	5.2	5.9
4-22	3	102, 103, 104	5.2	6.1
4-23	1	89	5.3	6.0
4-24	1	98	5.3	6.1
4-25	2	109, 110	5.3	6.2
4-26	3	103, 103, 107	5.4	6.3
4-27	2	81, 85	5.6	6.4
4-28	1	100	5.6	6.5
4-29	2	97, 101	5.7	6.6
4-30	4	106, 107, 108, 111	5.7	6.7

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score
4-31	1	83	5.9	6.7
4-32	1	101	5.9	6.8
4-33	4	105, 103, 104, 109	5.9	6.9
4-34	1	93	6.0	6.9
4-35	5	103, 103, 109, 110, 110	6.0	7.0
4-36	1	86	6.2	7.0
4-37	1	98	6.2	7.1
4-38	4	104, 106, 108, 109	6.2	7.2
4-39	1	91	6.4	7.3
4-40	4	105, 106, 109, 111	6.4	7.4
4-41	4	107, 109, 110, 111	6.6	7.6

5. Student attendance in mathematics will improve by 10 percent as indicated by analysis of the eighth grade attendance records compared to the ninth grade attendance records.

Process Objectives for the First Year

The process objectives were designed to create holding power in addition to meeting the academic needs of the participants. The process designed to meet the outcomes was as follows:

1. Place each student in a learning hierarchy that is consistent with his/her level of mastery as reported by the teacher and verified by the practitioner.

2. Provide each student with explicit statements of expected outcomes as reported by the teacher and verified by the practitioner.

3. Provide each student with the opportunity to progress through the learning hierarchy at a pace which is consistent with his/her rate of mastery as reported by the teacher and verified by the practitioner.

4. Provide opportunities for each student to experience success

by rewarding correct responses with praise when possible as reported by the teacher and verified by the practitioner.

5. Provide each student with concrete, diagrammatic, and abstract, as well as individual, small-group, and large-group learning experiences as reported by the teacher and verified by the practitioner.

6. Provide for constant assessment of student attainment of the stated objectives and provide methods for monitoring and reacting to results of this assessment as reported by the teacher and verified by the practitioner.

Outcome Objectives for the Second Year

Fourteen students scored at least 9.5 grade equivalents on the Metropolitan Mathematics Achievement Test for total skills at the end of the first year of the practicum. Five students transferred during the first year. These nineteen students were not included in the objectives for the second year. The first year's post-test scores are listed as pre-test scores for the second year.

The objectives of the Individualized Mathematics Laboratory System (IMLS) for each student during the second year (final 18 weeks) are listed below:

1. Computational skills grade equivalent scores of identified students will increase from pre-test scores listed to expected post-test scores listed, based on the Metropolitan Mathematics Achievement Test:

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score
1-1	2	81, 83	5.0	5.35
1-2	1	81	5.5	5.85

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score
1-3	1	95	5.6	6.00
1-4	1	102	6.7	7.20
1-5	2	101, 101	7.3	7.75
1-6	2	106, 106	7.3	7.80
1-7	1	89	7.7	8.15
1-8	1	98	7.7	8.20
1-9	1	83	7.9	8.35
1-10	3	91, 101, 101	7.9	8.40
1-11	5	103, 105, 105, 108, 109	7.9	8.45
1-12	3	86, 86, 89	8.1	8.55
1-13	3	93, 96, 97	8.1	8.60
1-14	5	103, 104, 106, 107, 108	8.1	8.65
1-15	4	103, 103, 104, 107	8.3	8.85
1-16	2	98, 101	8.5	9.00
1-17	2	106, 108	8.5	9.05
1-18	2	84, 86	8.8	9.25
1-19	4	97, 97, 98, 101	8.8	9.30
1-20	3	105, 106, 107	8.8	9.35
1-21	8	102, 103, 103, 105, 107, 107, 108, 109	9.2	9.75

2. Concept skills grade equivalent scores of identified students will increase from pre-test scores listed to expected post-test scores listed, based on the Metropolitan Mathematics Achievement Test:

Item	Students	I.Q.	Pre-Test Score	Expected Post-Test Score
2-1	2	81, 83	4.8	5.15
2-2	2	101, 101	4.8	5.20
2-3	3	86, 86, 89	5.1	5.45
2-4	3	96, 97, 98	5.1	5.50
2-5	1	106	5.1	5.55
2-6	1	102	5.3	5.75

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score
2-7	1	81	5.7	6.10
2-8	1	101	5.7	6.15
2-9	2	103, 107	5.7	6.20
2-10	1	89	6.1	6.50
2-11	2	95, 98	6.1	6.55
2-12	3	103, 104, 108	6.1	6.60
2-13	1	84	6.3	6.70
2-14	3	97, 101, 101	6.3	6.75
2-15	3	93, 98, 101	6.5	6.95
2-16	4	102, 105, 108, 108	6.5	7.00
2-17	1	97	6.9	7.35
2-18	1	107	6.9	7.40
2-19	1	83	7.5	7.90
2-20	1	91	7.5	7.95
2-21	2	105, 106	7.7	8.25
2-22	2	106, 107	8.1	8.65
2-23	1	103	8.5	9.05
2-24	1	86	8.7	9.15
2-25	3	105, 109, 109	8.7	9.25
2-26	7	103, 104, 105, 106, 106, 107, 108	9.1	9.65
2-27	3	103, 103, 107	9.3	9.85

3. Problem solving skills grade equivalent scores of identified students will increase from pre-test scores listed to expected post-test scores listed, based on the Metropolitan Mathematics Achievement Test:

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score
3-1	1	89	4.3	4.65
3-2	2	96, 97	4.3	4.70
3-3	2	81, 83	4.6	4.95

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score
3-4	1	89	5.4	5.75
3-5	1	98	5.4	5.80
3-6	2	102, 108	5.6	6.10
3-7	1	101	6.0	6.45
3-8	1	97	6.3	6.75
3-9	3	81, 86, 86	6.5	6.90
3-10	1	84	6.8	7.20
3-11	4	97, 101, 101, 101	6.8	7.25
3-12	1	101	7.0	7.45
3-13	1.	103	7.0	7.50
3-14	3	93, 98, 98	7.3	7.75
3-15	1	108	7.3	7.80
3-16	1	83	7.5	7.90
3-17	2	91, 101	7.5	7.95
3-18	5	103, 105, 105, 106, 108	7.5	8.00
3-19	1	107	7.9	8.45
3-20	3	105, 108, 109	8.1	8.65
3-21	1	95	8.5	9.00
3-22	7	103, 104, 104, 106, 106, 107, 107	8.5	9.05
3-23	1	86	8.8	9.25
3-24	1	109	8.8	9.35
3-25	9	102, 103, 103, 103, 105, 106, 106, 107, 107	9.1	9.65

4. Total skills grade equivalent scores of identified students will increase from pre-test scores listed to expected post-test scores listed, based on the Metropolitan Mathematics Achievement Test:

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score
4-1	2	81, 83	4.8	5.15

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score
4-2	2	81, 89	6.0	6.40
4-3	2	96, 97	6.0	6.45
4-4	1	102	6.0	6.50
4-5	2	101, 101	6.4	6.85
4-6	1	89	6.6	7.00
4-7	1	98	6.6	7.05
4-8	2	86, 86	6.7	7.10
4-9	1	101	6.8	7.25
4-10	1	98	6.9	7.35
4-11	3	103, 106, 108	6.9	7.40
4-12	1	95	7.1	7.55
4-13	1	84	7.3	7.70
4-14	5	93, 97, 97, 101, 101	7.3	7.75
4-15	3	105, 109, 108	7.3	7.80
4-16	1	83	7.6	8.05
4-17	1	91	7.6	8.10
4-18	6	103, 104, 105, 106, 107, 108	7.6	8.15
4-19	1	98	7.8	8.30
4-20	1	107	8.0	8.55
4-21	2	102, 109	8.1	8.65
4-22	3	103, 104, 106	8.2	8.75
4-23	4	105, 106, 107, 109	8.6	9.15
4-24	1	86	8.8	9.25
4-25	5	103, 103, 106, 107, 108	8.8	9.35
4-26	2	105, 107	9.0	9.55
4-27	1	103	9.2	9.75

5. Student attendance in mathematics will improve by 5 percent as indicated by analysis of the attendance in the first year of the program compared to the recorded extrapolated attendance in the 18 weeks of the second year as reported on the attendance records.

Process Objectives for the Second Year

The process objectives were designed to create holding power in addition to meeting the academic needs of the participants. The process designed to meet the outcomes was as follows:

1. Place each student in a learning hierarchy that is consistent with his/her level of mastery as reported by the teachers and verified by the practitioner.

2. Provide each student with explicit statements of expected outcomes as reported by the teachers and verified by the practitioner.

3. Provide each student with the opportunity to progress through the learning hierarchy at a pace which is consistent with his/her rate of mastery as reported by the teachers and verified by the practitioner.

4. Provide opportunities for each student to experience success by rewarding correct responses with praise when possible as reported by the teachers and verified by the practitioner.

5. Provide each student with concrete, diagrammatic, abstract, as well as individual, small-group, and large-group learning experiences as reported by the teachers and verified by the practitioner.

6. Provide for constant assessment of student attainment of the stated objectives and provide methods for monitoring and reacting to results of this assessment as reported by the teachers and verified by the practitioner.

7. Provide the traditional mathematics teachers with the names of the participants (IMLS students) enrolled in the traditional high school mathematics class as reported by the teachers and verified by the practitioner.

8. Provide directions to traditional mathematics teachers for returning participants (IMLS students) to the laboratory when skills deficiencies are identified as reported by the teachers and verified by the practitioner.

9. Return participants (IMLS students) to the traditional mathematics class when the skills deficiencies are corrected as reported by the teachers and verified by the practitioner.

CHAPTER IV

DEVELOPING A PRACTICUM DESIGN

Research Used in Developing the Design

Based on the ERIC search and review of other related literature, the practitioner concluded that some mathematics laboratories had been successful in improving mathematics skills. Some of this information was used in developing the design for this practicum. The research literature was limited on laboratory programs for low achievers.

Johnson stated that: "Relatively little attention has been devoted to the needs of other types of students, especially the ones often referred to as low achievers, ..."[5]

Bierden[6] found that for seventh grade children an intra-class grouping using small group instruction followed by independent work for individualized objectives resulted in significant gains in computational skills, concept knowledge, and attitude, with a reduction in anxiety. In a similar study, Lerch and Kelly[7] reported that seventh grade slow learners in a mathematics program using intra-class grouping and a

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[5]D. A. Johnson and G. R. Rising, Guidelines for Teaching Mathematics (Belmont, CA: Wadsworth Publishing Company, 1967), p. 191.

[6]J. E. Bierden, "Behavioral Objectives and Flexible Grouping in Seventh Grade Mathematics," Journal for Research in Mathematics Education 1 (January, 1970): 207-217.

[7]H. H. Lerch and F. J. Kelly, "A Mathematics Program for Slow Learners at the Junior High Level," The Arithmetic Teacher 13 (March, 1966):232-236.

topical approach adjusted to individual needs achieved more than students in conventional classes. Dreyfuss[8] developed a special junior high school mathematics program for low achievers which included activities such as field trips, individual and small group work, weekly evaluations, and devices such as records and tapes. The program led to significantly higher achievement than that obtained by a control group. This information assisted the practitioner in selecting a design that concentrated on individual needs, as well as individual and small group work.

Wasylyk[9] did a study to investigate certain aspects of mathematics learning in a laboratory instructional setting with low achieving high school students. An experimental program comprising twelve units of activity lessons was developed and used in place of the regular mathematics program for ten weeks in an instructional setting based on small group activity with physical materials and written problem sheets. The same mathematical content was presented during the same time to a control group of students in a conventional, teacher-directed class setting.

The subjects for the experiment were first year students at W. P. Wagner High School in Edmonton, Alberta, who had been randomly assigned to classes at the beginning of the school term. Of the twelve classes involved in the study, eight were taught by one teacher and four by another, and half of each teacher's classes were randomly assigned to each of the treatment groups.

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[8]C. O. Dreyfuss, "A Study of Special Education Programs for the Disadvantaged Student with a High Academic Potential," Dissertation Abstracts 29 A (1969):3366.

[9]Eugene Wasylyk, "A Laboratory Approach to Mathematics for Low Achievers in High School" (Ph.D. dissertation, University of Alberta, Edmonton, Alberta, 1973), pp. 1-93.

Attitude and achievement in mathematics both prior to and at the conclusion of the experiment were measured mainly by investigator-prepared instruments, as were students' and teachers' views on instructional setting at the conclusion of the study. Hypotheses were tested using analysis of variance and chi square.

The study found that on all criterion measures the experimental group surpassed the control group significantly and that students and teachers held positive views on the laboratory instructional setting.

The study concluded, within the limitation of the experiment, that a laboratory approach in mathematics can be used successfully with low achieving high school students. This study was useful in developing the strategy for selecting students with a history of failure in mathematics.

Silbaugh's results of a study of the effectiveness of a multi-activities laboratory in the teaching of seventh grade mathematics are found below:

Summary of Findings

1. There was a significant difference in mathematics achievement of students having access to a laboratory in their schools and of students in schools with no laboratories. The growth differential as expressed in grade equivalents was five-tenths of a grade higher for the students attending a multiple-activities mathematics laboratory twice a week for a school year, and four-tenths of a grade higher for the students who simply had access to a laboratory in their schools.

2. There was a mean difference of achievement in mathematics of one-tenth of a grade between those students attending the multiple-activities laboratory on a regular basis, and those having access to a laboratory in their schools.

3. Girls showed greater growth in mathematics achievement when in schools with laboratories than boys, but the mean growth was the same for boys and girls in schools without mathematics laboratories.

4. The attrition rate was extremely high of both boys, 36.4 percent, and girls, 26.6 percent. However, the attrition rate was much less in schools with laboratories, 27.1 percent, than in schools with no laboratories, 40.8 percent.

Recommendations

On the findings of this research, the following recommendations are made:

1. That each District of Columbia Junior High School should have at least one operating mathematics laboratory.

2. That, when a mathematics laboratory is operational in every District of Columbia Junior High School, further research be undertaken to test the effectiveness of such laboratories, and that this research incorporate the same schools used in this experiment.

3. That further research be undertaken to test the effectiveness of different types of laboratory programs in mathematics.

4. That an instrument be devised to test motivation in the study of mathematics. The only one this researcher could locate was the instrument used in the Longitudinal Study conducted by School Mathematics Study Group and it has not been standardized. In fact, it was highly unsuitable for the seventh grade students in this sample.[10]

Dittmer[11] did a study to determine the current status of mathematics laboratories in the secondary schools and to formulate guidelines for further development. Included among the findings were that preservice preparation of teachers did not include mathematics laboratories, the mathematics laboratory was used most frequently at the seventh through tenth grade levels, and the laboratory seemed most effective for the low achiever.

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[10] Charlotte Silbaugh, A Study of the Effectiveness of a Multi-Activities Laboratory in the Teaching of Seventh Grade Mathematics to Inner-City Students (Arlington, VA: ERIC Document Reproduction Service, ED 076 370, 1972).

[11] Karen Ann Dittmer, Guidelines for Developing a Mathematics Laboratory (Arlington, VA: ERIC Document Reproduction Service, ED 071 861, 1971).

This information was used in making the decision to return those second year participants enrolled in traditional classes to the laboratory when skills deficiencies surfaced.

Jones[12] reported a pilot study in which a modified programmed-lecture and mathematical-game approach was used to instruct two classes of ninth grade students having a history of failure in mathematics. Games were introduced to illustrate practical applications of learning mathematics and ways of having fun with mathematical ideas. Analysis of the pre-test and post-test scores on a standardized arithmetic test revealed that all students had made statistically significant grade level gains over the nine week experimental period. The number of students in the two classes with favorable attitudes toward mathematics increased from 11 percent and 8 percent in the spring to 77 percent and 84 percent respectively in the summer. The practitioner's plans to select students with a history of failure in mathematics was reinforced by this information.

Further research revealed that the teacher in a laboratory setting is no longer the central figure in the classrooms. The teacher should act as a motivator and source of ideas, as well as having all materials available. In this capacity the teacher is an educational counselor.[13] Because of the individual contact with each student, the teacher will become more aware of the student's weakness. The teacher is expected to

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[12]Thomas Jones, "The Effect of Modified Programmed Lectures and Mathematical Games upon Achievement and Attitude of Ninth Grade Low Achievers in Mathematics," The Mathematic Teacher 61 (October, 1968): 603-607.

[13]G. A. Kaye, "New Role for the Teacher," The Arithmetic Teacher 16 (January, 1969):47.

diagnose, prescribe, and evaluate on an individual basis.[14] This information assisted the practitioner in developing the teachers' strategy for handling the methods of instruction used in the Washington High School setting.

Selection of Materials

The practitioner, a former mathematics teacher, chose the initial individualized mathematics materials and decided, with teacher input, on the methods and techniques that were used by the teachers. The teachers also participated in the selection and development of some materials. The selection of the individualized mathematics materials was based on the Metropolitan Mathematics Achievement Test results, students' performance records, interviews with mathematics teachers, and the review of related studies and literature.

The practitioner concluded that each student would improve his/her mathematics skills if: (a) placed in a learning hierarchy consistent with his/her level of mastery, (b) provided with explicit statements of expected outcomes, (c) provided with the opportunity to progress through the learning hierarchy at a pace consistent with his/her rate of mastery, (d) provided with opportunities to experience success by being rewarded with praise whenever possible for correct responses, (e) provided with concrete, diagrammatic, and abstract, as well as individual, small-group, and large-group learning experiences, (f) provided with constant assessment of attainment of the stated objectives, (g) provided with methods of monitoring and reacting to results of assessment, and (h) provided with an opportunity to participate in a class that did not award failure grades.

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[14] Lola J. May, "Teaching Tools: How to Use Them in Mathematics," Grade Teacher LXXXVII (February, 1970):128.

The individualized mathematics materials chosen for use at Washington High School consisted of parts of the Individualized Mathematics System published by Ginn and the Individualized Computation Skills Series published by Holt, Rinehart and Winston. These individualized mathematics materials were modified to assist students who scored at grade equivalents three through eight on the Metropolitan Mathematics Achievement Test.

Individualized Mathematics System Kit

The portions of the Individualized Mathematics System Kit selected for use at Washington High School consisted of up to nine levels, Unit Levels IV through XII. These units were designed to develop skills for students with grade equivalent ranges of 3.0 up to 9.0. The grade equivalent scores were determined as a result of the Metropolitan Mathematics Achievement Test.

Unit levels IV through IX consisted of six levels of difficulty and contained activities in skill folders designed for students who scored from 3.0 to 7.0 grade equivalents. Each Unit Level contained eleven strands. Each strand within the level contained one to eleven performance objectives that were explicitly stated in the eleven strand hierarchy. These statements formed the learning hierarchy of the program.

The eleven strands for Unit Levels IV through IX were: (a) Numeration, (b) Addition, (c) Subtraction, (d) Multiplication, (e) Division, (f) Fractions, (g) Applications, (h) Money, (i) Time, (j) Measurement, and (k) Geometry. There were six levels of difficulty for each strand. A scope and sequence chart for Unit Levels VII through IX, including the unit strands and content, are found in Appendix C, Pages 98-99.

Each Unit Level contained forty-six to fifty-six skill folders for the eleven strands in the level, twelve copies of each unit pre- and post-test, and a ten to twelve minute placement test. A typical example of the activities found in the Individualized Mathematics System Kit is found in Unit Level VII. Examples of activities for each strand in Unit Level VII are found in Appendix C, Pages 97-136.

Unit Levels X through XII contained activities in skill folders designed for students who scored from 7.0 to 9.0 grade equivalents. Each Unit Level contained units of seven strands. Each strand within a level consisted of two to ten performance objectives. The objectives were explicitly stated in the seven strand hierarchy, and these statements completed the learning hierarchy for the Individualized Mathematics System Kit.

The seven strands included in Level Units X through XII were: (a) Numeration, (b) Rational Numbers, (c) Computations, (d) Problem Solving, (e) Geometry, (f) Measurement, and (g) Pre-Algebra. Some examples of the objectives of the activities in these strands are found below:

Numeration Level XI

Skill 3: Given a decimal, the student will be able to show the number in expanded form.

Skill 4: Given problem situations involving decimals, the student will be able to use rounding, ordering, and estimating to answer questions.

Rational Numbers Level XI

Skill 4: Given a coordinate plane and a number pair, the student will be able to graph the number pair.

Skill 5: Given a coordinate plane and a rule for a linear relation, the student will be able to make a table of number pairs and graph the points in a line.

Computations Level XI

Skill 7: Given two rational numbers in decimal, fraction, or mixed form and a flow chart for dividing rational numbers, the student will be able to find the quotient.

Skill 8: Given two rational numbers in different forms, the student will be able to change the form of either number in order to compute.

Problem Solving Level XI

Skill 4: The student will be able to solve probability problems by using the counting principle or by multiplying.

Skill 5: The student will be able to use factorial notation to answer word problems involving multiplication.

Geometry Level XI

Skill 4: Given a triangle and a constant ratio, the student will be able to draw a triangle similar to the original with sides in the constant ratio given.

Skill 5: Given a set of triangles, the student will be able to identify similar triangles and give the constant ratio between the corresponding sides.

Measurement Level XI

Skill 3: Given a protractor, the student will be able to draw parallel lines.

Skill 4: Given a compass and a ruler, the student will be able to draw a circle of a specified radius.

Pre-Algebra Level XI

Skill 3: Given a mathematical expression or equation, the student will be able to use the properties to simplify computation and find an equivalent equation.

Skill 4: Given an inequality, the student will be able to use the properties to simplify, find an equivalent inequality, and graph the solution on a number line.

Each unit contained from ten to eighteen skills folders, seven pre- and post-tests, and a student answer key.

Individualized Computation Skills Series Kit

The Individualized Computation Skills Series Kit was used to supplement the Individualized Mathematics System Kit. The portions of the Individualized Computation Skills Series Kit used at Washington High School consisted of eight self-study units contained in three sets. Set 1 dealt with whole numbers and included three units, units 1, 2, and 3. Unit 1 was composed of activities that involved addition and subtraction of whole numbers. Unit 2 was composed of activities that involved the multiplication of whole numbers. Unit 3 was composed of activities that involved the division of whole numbers. Set 2 was composed of activities that used fractions and consisted of units 4 and 5. Unit 4 included activities that involved the multiplication and division of fractions. Unit 5 included activities that involved the addition and subtraction of fractions. Set 3 concentrated on activities that dealt with decimals and percents and consisted of units 6, 7, and 8. Unit 6 was composed of activities that involved the addition and subtraction of decimals. Unit 7 was composed of activities that involved the multiplication and division of fractions. Unit 8 concentrated on activities that involved working with percents.

Portions of the Individualized Computation Skills Series Kit were used at Washington High School to supplement those activities that involved the use of whole numbers, fractions, decimals, and percents. Each of the eight self-study units contained individualized study practice sheets and answer cards. Examples of activities in unit 5, Addition and Subtraction of Fractions, are found in Appendix D, Pages 137-147.

Teacher Prepared Materials

Teacher prepared materials were also used in the Individualized Mathematics Laboratory System at Washington High School. The materials were prepared for individuals based on his/her performance profile, reflecting the individual's needs in order to master a particular skill. The teacher prepared materials supplemented portions of the Ginn Individualized Mathematics System Kit that were used in the practicum.

Selection of Participants

Teachers

In the spring of 1977 the position of an individualized mathematics laboratory teacher for low achievers was advertised. In the spring and summer of 1977 five teachers applied for the position of teacher for the Individualized Mathematics Laboratory System (IMLS). The IMLS program was a laboratory program that consisted of components of the Ginn Individualized Mathematics System program and the Holt, Rinehart and Winston Individualized Computation Skills Series program, along with teacher prepared materials, taught in a laboratory setting. A teacher with a background in mathematics and special education was selected from the applicants to teach the program. The teacher was assigned an aid who had two years of college and was interested in working with low achievers.

The practitioner concluded that a teacher trained in special education was better able to deal with the demands and needs of the special groups of low achievers selected for the program. A volunteer counselor was selected to assist the practitioner and laboratory teacher with scheduling.

In August, 1978, during the second year of the program, a second teacher was added. This teacher was selected from four applicants. She had one year of experience in working with low achievers. Her experience was in an individualized eighth grade mathematics class designed for low achievers.

Students

The practitioner studied the potential ninth graders' mathematics scores and school records in the spring of 1977 and developed the criteria for student selection. The criteria for selecting the students in the program was that they: (a) had been administered the Metropolitan Mathematics Achievement Test, (b) possessed total mathematics skills below the eighth grade equivalent, and (c) failed mathematics in the eighth grade. In the event that fewer than seventy-five students were selected, based on the stated criteria, a contingency selection plan was developed for selection. The contingency plan changed criterion (c) to read: selected by the counselor. The selections were based on the lowest scores recorded on the Metropolitan Mathematics Achievement Test.

Seventy-five students were selected to participate in the program. The students were scheduled into five 55-minute classes with fifteen students in each class. All of the classes met in the same room, the mathematics laboratory.

CHAPTER V

IMPLEMENTING THE PRACTICUM DESIGN

Training of the Teachers During the First Year

After the selection of the participants and materials had been made, the practitioner focused attention upon the training of the teacher, teacher's aid, and counselor in preparation for the first year of the practicum. The practitioner spent five 1-hour sessions training the teacher and teacher's aid. The counselor was told that her role was simply to schedule the students for classes. Five classes were scheduled with fifteen students in each class. The practitioner met with the teacher and teacher's aid one hour per week, after the students were admitted to classes, to discuss teacher and developmental concerns.

The practitioner began the first session during the week of August 29, 1977, the week of teacher orientation for the school corporation. He told the teacher and teacher's aid that they would be involved in implementing a new individualized mathematics instructional program called the Individualized Mathematics Laboratory System. This system involved working with portions of the Individualized Mathematics System by Ginn, the Individualized Computation Skills Series by Holt, Rinehart and Winston, and teacher prepared materials. It was pointed out that the Ginn Individualized Mathematics System was the major component of the program.

It was explained that the Individualized Mathematics Laboratory System was designed to make mathematics more interesting for everyone, students and teachers alike. The IMLS classes were designed so that students often worked together in teams and/or seminars, but the focus of the curriculum was on the individual working at his/her own pace. Students are different in many ways; they develop at different rates, have different desires, possess unique abilities, and learn in his/her own way. It was made clear that failure grades did not fit into the design of the Individualized Mathematics Laboratory System. It was designed so that each student determined his/her own rate of progress. The roles of the teacher and teacher's aid were to work with students individually and/or in small groups on specific problems. The teacher assumed a role of teacher and educational counselor, one who guided the students through the different steps, diagnosed, prescribed, and evaluated on an individual basis. It was emphasized that the teacher provided the reinforcement of confidence needed by praising students when mastery of a unit or task occurred.

The practitioner introduced the teacher and teacher's aid to the portions of the Ginn Individualized Mathematics System that were to be used at Washington High School. The teacher and the aid learned that the students would be working on laminated skill folders, which were the basics for the instruction. The skill folders were stored on a cart, and each student was to receive his/her own student folder to keep his/her materials together. In addition, a teacher folder was kept on each student. The Ginn Kit provided a mathematics placement test, pre-tests, post-tests, and curriculum for each student with a grade level equivalent of 3.0 to 9.0. The content and levels of difficulty were structured by

Unit Levels, Levels IV through XII. The content was divided into fifteen different topics, with up to nine levels of difficulty for each topic. The practitioner, teacher, and teacher's aid reviewed the IMLS learning flow chart and discussed the steps. The individualized mathematics learning flow chart shows how the program was designed at Washington High School. The flow chart is found in Appendix B, Page 93.

The first step for getting into the cycle was the Metropolitan Mathematics Achievement Test, followed by a placement test. Each student had to take the placement test upon entering the program. The results of the test guided the teacher and teacher's aid in deciding where the student would begin in each of the content strands. Based on the results of the placement test, the teacher and teacher's aid created an initial profile sheet for each student. The teacher and aid found that the profile form gave a graphic record of the units the student had mastered. The profile form identified where the student was working at any time throughout the year. The teacher was directed to continually update the record as the student progressed through the individualized program. There was a block on the profile form for each unit. Original mastery, as measured by the placement test, was shown by an X in the block; subsequent unit completion was shown by the pre- and post-test dates, separated by a diagonal line in the block. An example of the student profile sheet is found in Appendix B, Page 94.

The teacher and teacher's aid learned that a short pre-test was given at the beginning of each unit and checked by the teacher. The pre-test indicated which specific skills needed to be completed in a particular unit. Students recorded the skill pages and activities that they prescribed for a task on the prescription form which became a

contract between the teacher and the student. A prescription form was created for each unit encounter. Sometimes more than one form was necessary to complete the prescription. An example of a prescription form is found in Appendix B, Page 95.

The practitioner suggested that the Individualized Mathematics Laboratory System would provide students with the opportunities to learn new skills by engaging in various kinds of activities. The teacher and aid learned that most of the work would be individually concentrated on the Ginn laminated skill pages. The laminated pages required the use of special pencils and cloth erasers. Students worked on the Holt Individualized Computation Skills Series and teacher prepared materials when the teacher determined the need. The first session ended with the practitioner dealing with questions and concerns raised by the teacher and teacher's aid.

The second session began with the practitioner describing the post-test. It was explained that there were several post-tests for each of the units. These tests measured mastery of the performance objectives that were stated for each strand in the units. It was pointed out that these tests were to be corrected by the teacher or aid as soon as possible and recorded on the student profile sheet. If mastery was attained, the student proceeded on to the next unit of study. The teacher and aid were asked to role play taking a placement test, finding their levels on the student profile correlation sheet (the profile correlation sheet indicated the scores needed for placement in a particular level), taking a pre-test based on their profile correlations, and completing a profile sheet. A student profile correlation sheet for levels IV through IX is found in Appendix B, Page 96.

During the third session, the practitioner indicated that the teachers had received an overview of the steps in the learning cycle. He explained the steps in more detail. He started with the placement tests and explained that placement tests were a series of short tests, one for each of the topic units. It was stressed that each student was to take only two or three tests per day during student orientation. Each test required about ten to fifteen minutes. Students were not expected to complete all of the items but directed to go as far as they could. They were to write in the test booklet and stop when they finished with each test. Teachers were to collect the test booklets at the end of each testing session and correct them on the same day. The teacher was able to determine the students' beginning Unit Levels by using the student profile correlation.

The practitioner explained that the sequence followed for the remainder of the preservice was basically the same as they would use with their students during student orientation. Student orientation to the program was scheduled the first week that students participated in the program.

The practitioner pointed out that the first step was to introduce the basic instructional materials to the students, the skill folders. These folders were kept on the IMLS cart. The students first task was to learn how to find specific skill folders. They needed to be able to find the topic, the level, and the skill for the folder they wanted. The folders had the name of the unit, the level, and the skill number written on them.

He explained that the cart contained skill folders for levels IV through XII. It was loaded so that level IV started at the left

corner, followed by level V, level VI, and level VII until one side was filled. The other side of the cart was loaded until level XII was finished. The Holt individualized materials were located on the bottom of the cart, along with teacher prepared materials. The number of strands of a particular skill placed on the cart was determined by the number of students and their levels. Cardboard labels were placed between the levels to help students locate the levels of materials they needed. The teacher and teacher's aid were then directed to role play finding various skill folders.

During the fourth session, the instructions continued to the next task—learning how to remove and return folders on the cart. This activity required the use of a folder place holder which was used to mark the place where a skill folder had been removed. This enabled the student to determine exactly where the folder should be placed when he/she returned it to the cart.

The practitioner gave the teacher and teacher's aid a piece of cardboard 8½ inches by 14 inches and asked them to put the numbers 1 and 2 respectively in the upper-left corner of the cardboard to identify their specific place holder. They then role played removing and replacing materials on the IMLS cart. It was stressed that each student needed a place holder with his/her student number recorded in the upper-left corner, and each should be given the opportunity to practice locating and removing folders. Folders were selected by writing down the topic level and skill needed.

Emphasis was placed on the need for students to practice using the laminated pages and special grease pencils for writing on the skill pages. It was suggested that the teacher and teacher's aid keep two

boxes of pencils in the classroom (one marked READY FOR USE and another NEEDS SHARPENING) and train a few students to sharpen the pencils on a rotating basis. It was also suggested that a box containing discarded cloth should be made available for erasers.

The teacher and teacher's aid were cautioned to make sure students looked at the top of the pages carefully to find the directions before starting work on the skill folders. Students were directed to correct their own skill folder work. The answer keys were kept in the back of each skill folder. The teacher and aid were instructed to direct students to place a C by the correct responses and an X next to the incorrect answers. One point was scored for each correct response. They were urged to make sure that the completed folders were carefully erased, since other students would probably use the same folders. They were further directed to impress on students the need for returning skill folders, answer keys, pencils, and erasers to the proper places so that other students would be able to find them.

The practitioner explained the need for teachers to prepare a folder for each student to keep up with his/her materials. The folders were to be placed in one of the following boxes: (a) an OK BOX from which students would take their folders at the beginning of each period and return them at the end of the period if they did not need assistance, (b) a QUESTION BOX in which folders were placed if the students needed assistance, or (c) a TEST BOX in which students put their folders if they had taken a pre-test or post-test that needed to be corrected. It was pointed out that teachers should also keep a folder on each student containing his/her profile.

They learned that the following items should be placed in the student's folder: (a) a student help flag which the student was to place on his/her desk when help was needed, (b) a student profile form, and (c) a current student prescription form.

The practitioner suggested that after the first seven days of student orientation the placement test and the skill folders practice session were to be completed. Students would then be ready to move to the learning cycle. The placement test would be used to create an initial profile for each student. The teacher was to circle the scores on the profile correlation form at the front of the placement test booklet and use the scores to create a profile.

When the student understood the units included in his/her profile placement, he/she was to begin filling in the prescription form. The student's name, unit level, period, and date were to be recorded at the top of the form to indicate he/she would be taking the pre-test; the student's initials were to be entered and the word pre-test. The teacher and teacher's aid were asked to role play prescription writing for this portion of the form.

It was explained, during the fifth session, that after a profile was created the student would move to the learning cycle. The student would then locate the pre-test. The pre-tests and post-tests were kept in folders and placed behind each unit on the cart. The practitioner cautioned them that students should not talk to anyone or ask questions during the pre- and post-test. When the test was finished, it was to be corrected. It was now time to role play finding the test. The teacher and aid were told to use the information from the prescription form they filled out to take the pre-test from the cart for that unit. They were

told to complete the test and pretend to miss some questions.

After the role playing session, the teacher and teacher's aid were ready to prescribe instruction. First, they were instructed to correct the pre-test and record the results on the student prescription form. Then, they were to enter the number of questions which needed to be answered correctly to show that the skill had been mastered and the total number of questions on the test. These numbers were found on the pre-test. Then they entered the questions answered correctly and drew a ring around the unmastered skills, the skills the student would work on in the unit. The first prescription was for the first skill circled. The students were to perform this task themselves. The teacher and aid were directed to assist students in making the decision of which pages to prescribe in the skill folders, by looking at the guideline page found inside of each folder, until the student became familiar with the system.

When a student had completed the work for each of the circled skills in the skill folders, and if needed the assigned Holt and teacher prepared activities, he/she took a post-test. The post-tests were found behind the pre-tests. The aid or teacher corrected the post-test immediately. If the student did not demonstrate mastery, then the teacher, teacher's aid, or another peer may work with the student. The teacher may want to prescribe a teacher- or student-centered rap session for students working on the same skill folders.

The practitioner indicated that classroom observations and student folder inspections would be made periodically to assist teachers in meeting the teacher objectives that:

1. Provided each student with a student folder.
2. Placed each student in a learning hierarchy that was consistent

with his/her level of mastery.

3. Provided each student with explicit statements of expected outcomes.

4. Provided each student with the opportunity to progress through the learning hierarchy at a pace which was consistent with his/her rate of mastery.

5. Provided opportunities for each student to experience success by rewarding correct responses with praise whenever possible.

6. Provided each student with concrete, diagrammatic, and abstract, as well as individual, small-group and large-group experiences.

7. Provided for constant assessment of student attainment of the stated objectives and provided methods of monitoring and reacting to the results of the assessment.

The practitioner suggested that the teacher objectives would certainly be met by following the steps described in the pre-service sessions.

Training of the Teachers During the Second Year (Eighteen Weeks)

A second teacher was added in August of 1978 to work in the laboratory with the existing IMLS teacher and teacher's aid during the second year of the practicum.

The existing IMLS teacher and the practitioner conducted pre-service sessions for a total of five hours to prepare the new teacher in the program design. The pre-service sessions repeated the training covered in the first year. In the pre-service meetings the following program characteristics were covered: (a) the new role as an IMLS teacher, (b) the system components, (c) the performance objectives,

(d) the IMLS learning cycle, (e) placement tests, (f) preparing and interpreting a profile form, (g) pre-testing, (h) prescription writing, (i) working in skill folders, the supplementary teacher prepared materials, and the Holt individualized materials, (j) post-testing, (k) updating the profile, and (l) prescribing the new unit.

It was pointed out that the thirty-seven students who scored below the eighth grade equivalent on the Metropolitan post-test at the end of the first year of the practicum were returned to IMLS classes for a second year. The nineteen students who scored from 8.0 to 9.4 grade equivalents were scheduled into the traditional high school arithmetic classes. These students were scheduled to return to the IMLS classes when skills problems surfaced. Upon mastery of the skills problems, these students were returned to the traditional classes. Students who scored at least 9.5 grade equivalents were not returned to the program and were scheduled into arithmetic-algebra-geometry classes.

The IMLS teachers were cautioned to continue updating the prescriptions for all students, students who returned for daily instruction and the temporary students. A list of the names of IMLS students enrolled in traditional arithmetic classes was placed in the hands of the traditional arithmetic teachers. The list was preceded by instructions to return the students who were experiencing particular skill(s) problem(s) to the laboratory for assistance in solving the problem(s). The traditional arithmetic teachers were informed that these students would be returned to the traditional class upon mastery of the skill.

The practitioner indicated that classroom observations and student folder inspections would be made periodically to assist teachers in meeting the teacher objectives that:

1. Provided each student with a student folder.

2. Placed each student in a learning hierarchy that was consistent with his/her level of mastery.

3. Provided each student with explicit statements of expected outcomes.

4. Provided each student with the opportunity to progress through the learning hierarchy at a pace which was consistent with his/her rate of mastery.

5. Provided opportunities for each student to experience success by rewarding correct responses with praise whenever possible.

6. Provided each student with concrete, diagrammatic, and abstract, as well as individual, small-group and large-group experiences.

7. Provided for constant assessment of student attainment of the stated objectives and provided methods of monitoring and reacting to the results of the assessment.

8. Provided the traditional mathematics teachers with the names of the IMLS students enrolled in traditional high school mathematics classes.

9. Provided directions to traditional mathematics teachers for returning IMLS students to the laboratory when skills deficiencies were identified.

10. Returned IMLS students to the traditional mathematics class when the skills deficiencies were corrected.

The practitioner met with the teachers and aid one hour per week during the second year of the program to discuss the concerns of the teachers and the aid.

Student Orientation

The orientation for students began the first day that classes met, September 6, 1977. The IMLS teacher explained to the students that they would be involved in a new and different mathematics program for the next thirty-six weeks, possibly the next fifty-four weeks, depending upon their achievement. It was explained that each student would receive one credit in mathematics for each semester of participation in the program, which was called the Individualized Mathematics Laboratory System or IMLS. She explained the components of IMLS and indicated that for the next six to seven days they would learn about the program and find out how it worked for each individual. It was pointed out that since each student was different, each student had his/her own interests, abilities, needs, and, most importantly, each student learned in his/her own way. The teacher and aid indicated they would work with each individual to help him/her learn what was needed concerning the assignments and that the activities were structured so the assignments were not too hard or too easy. It was made clear that the program was designed for individual work but that students sometimes worked in teams and engaged in group discussions with or without the teacher. Each student was given a folder in which to keep the profile prescription form, a help flag, and a place holder.

The teacher reviewed the flow chart of the IMLS learning cycle and told them that the cycle demonstrated student activities in the program. Each student understood that he/she would always use the same steps. She went through the steps. The first step, upon entering the program, was to take the Metropolitan Mathematics Achievement Test; the next step was to take the placement test that contained a ten to fifteen

minute test for each unit. The placement test helped the teacher decide where each student was to start his/her work. It was pointed out that a profile would be developed for each student, based on the placement test. The placement test indicated for the teacher and student what the student already knew and helped the teacher decide on which unit the student would begin work. A copy of the profile form was kept in the student's and teacher's folders.

She explained that the pre-test would be used to determine what needed to be done in the unit. She told the students that each of them would receive a prescription form that showed exactly where each student would be working, based on the results of the pre-test. It was pointed out that the form would be kept in the student folders at all times during the prescription period and returned to the teacher after the tasks were completed. Students were instructed to write their own individual prescriptions after they learned the program. She pointed out that in the next step students would work in skill folders, the Holt individualized program, and teacher prepared materials.

The teacher made it clear that students who worked in the skill folders would use special pencils and cloth erasers. Each student was given a placement holder with his/her student number on it, and then the teacher explained how to use the holder.

The last step was to take the post-test. The students learned that when they had successfully completed the post-test they would move to the next unit and begin the cycle again, starting with the pre-test. It was explained that students who were unsuccessful in completing the post-test would be prescribed additional activities until the post-test had been successfully completed. These activities might include working in the

skill folders, working with the Holt individualized materials, working with teacher prepared materials, and/or working with the teacher, aid, or peers individually or in groups.

The teacher explained that the placement test would begin on the first day of class and would end after seven days. After each day's tests, students practiced the following: (a) locating, using, and returning skill folders on the IMLS cart, (b) locating, using, and returning the Holt individualized materials, and (c) locating, using, and returning the teacher prepared materials.

After the seventh day of testing was completed, the teacher conducted a question-and-answer period concerning the program.

On the eighth day of the program, the teacher's discussion centered around the students' mathematics folders and their contents. A sample student profile form, a sample prescription form, a skill folder pencil, a paper flag, and a place holder were placed in the student folder.

The sample forms were reviewed with each class. The profile form and the prescription form were reviewed in detail. It was explained that student activities in the units depended on the individual profile and prescription. A question-and-answer period consumed the remainder of the class period.

Getting Started

By the ninth day, the placement test had been corrected, and student profile forms had been completed for each student. The teacher and aid distributed to each student a copy of his/her profile form. The teacher explained how to read the form and determined the units in which

each student should begin his/her activities. The students were told to file the forms and keep them in their folders.

Each student received a prescription form and was directed to fill in the information at the top of the form using the profile sheet. They were told that the first entry in each new unit was the pre-test for that unit. The students were directed to find the pre-test indicated for his/her profile. Each student's selection was checked to confirm that the proper pre-test had been selected. Those students who experienced selection problems were sent back to the cart in pairs, and the teacher supervised the selection. It was explained that the pre-tests were designed to help prescribe the correct instructional activities and that they were not for grades. The teacher and teacher's aid wrote the prescription for each student after the student completed the test. The teacher and aid pointed out that the student would write his/her own prescription for each unit in the future. The teacher demonstrated on the chalk board how to write a prescription using the pre-test information.

The class period ended, and the students were directed to place the folders in the proper boxes.

On the tenth day of class, the review of prescription writing continued. The students were told that if mastery was not demonstrated from student prescribed work in the Ginn individualized skill folders, the teacher or teacher's aid would assist the student in prescribing additional activities. These activities might include working in the skill folders, working with the Holt individualized materials, working with teacher prepared materials, and/or working with the teacher, aid, or peers individually or in groups. The students began their prescribed work. Each student took a post-test upon completion of the prescription.

When mastery was demonstrated on the post-test, the teacher updated the student's and teacher's profile form by entering the date completed.

The cycle was repeated, starting with the pre-test. This cycle continued throughout the fifty-four weeks of the practicum. The participants were given the Metropolitan Mathematics Achievement Test at the end of thirty-six weeks of participation. The students who returned for daily or temporary instruction for the second year were again given the Metropolitan Mathematics Achievement Test at the end of fifty-four weeks of participation.

CHAPTER VI

EVALUATION

Evaluation of the Achievement of Process Objectives

Analysis of the Process Objectives for the First Year

The practitioner met with the teacher and teacher's aid weekly to discuss teacher concerns and evaluate program process. He also made monthly classroom visits to inspect folders and make program observations.

Analysis of process objective one

Objective one during the first thirty-six weeks of the practicum was to:

1. Place each student in a learning hierarchy that is consistent with his/her level of mastery as reported by the teacher and verified by the practitioner.

Each student's folder was inspected during classroom visits by the practitioner. The visits began the third week of the practicum and continued monthly following the initial visit. The folder checks revealed that the teacher had developed a profile for each student based on the placement test. The student worked on skills based on the profile. The profile was consistent with his/her level of mastery.

Analysis of process objective two

Objective two during the first thirty-six weeks of the practicum was to:

2. Provide each student with explicit statements of expected outcomes as reported by the teacher and verified by the practitioner.

The prescription forms were checked during the monthly folder inspections. The practitioner found that student prescriptions always included skill folder activities. All skill folder activities contained statements of the expected outcomes.

Analysis of process objective three

Objective three during the first thirty-six weeks of the practicum was to:

3. Provide each student with the opportunity to progress through the learning hierarchy at a pace which is consistent with his/her rate of mastery as reported by the teacher and verified by the practitioner.

The practitioner inspected the students' folders monthly during classroom visitations. The prescription forms were checked to determine if students were given the opportunity to work at a level consistent with his/her rate of mastery until they were able to master the post-test at that level. The inspections revealed that students were given the opportunity to successfully complete one level of activities before advancing to a higher level of activities.

Analysis of process objective four

Objective four during the first thirty-six weeks of the practicum was to:

4. Provide opportunities for each student to experience success by rewarding correct responses with praise when possible as reported by the teacher and verified by the practitioner.

The practitioner's monthly visits to the classroom involved observations. The observations revealed that students were praised upon successful completion of a task.

Analysis of process objective five

Objective five during the first thirty-six weeks of the practicum was to:

5. Provide each student with concrete, diagrammatic, and abstract, as well as individual, small-group, and large-group learning experiences as reported by the teacher and verified by the practitioner.

The practitioner reviewed students' folders during monthly classroom visitations. The review of prescriptions and classroom observations revealed that students were provided with the stated activities and learning experiences.

Analysis of process objective six

Objective six during the first thirty-six weeks of the practicum was to:

6. Provide for constant assessment of student attainment of the stated objectives and provide methods for monitoring and reacting to results of this assessment as reported by the teacher and verified by the practitioner.

The practitioner checked the students' folders during the monthly visits. The folder checks revealed that student prescriptions and student profiles were constantly updated in reaction to student assessment.

Analysis of the Process Objectives for the Second Year

The practitioner met with the teachers and teachers' aid weekly during the second year (final 18 weeks) to discuss teacher concerns and

evaluate program process. He also made monthly classroom visits to inspect folders and make program observations.

Analysis of process objective one

Objective one during the second year (final 18 weeks) of the practicum was to:

1. Place each student in a learning hierarchy that is consistent with his/her level of mastery as reported by the teachers and verified by the practitioner.

Each student's folder was inspected during classroom visits by the practitioner. The monthly folder checks revealed that the teachers continued to update the student profile for each student based on his/her level of mastery.

Analysis of process objective two

Objective two during the second year (final 18 weeks) of the practicum was to:

2. Provide each student with explicit statements of expected outcomes as reported by the teachers and verified by the practitioner.

The prescription forms were checked during the monthly folder inspections. The practitioner found that student prescriptions always included skill folder activities. All skill folder activities contained statements of the expected outcomes.

Analysis of process objective three

Objective three during the second year (final 18 weeks) of the practicum was to:

3. Provide each student with the opportunity to progress through the learning hierarchy at a pace which is consistent with his/her rate

of mastery as reported by the teachers and verified by the practitioner.

The practitioner inspected the students' folders monthly during classroom visitations. The prescription forms were checked to determine if students were given the opportunity to work at a level consistent with his/her rate of mastery until they were able to master the post-test at that level. The inspections revealed that students were given the opportunity to successfully complete one level of activities before advancing to a higher level of activities.

Analysis of process objective four

Objective four during the second year (final 18 weeks) of the practicum was to:

4. Provide opportunities for each student to experience success by rewarding correct responses with praise when possible as reported by the teachers and verified by the practitioner.

The practitioner's monthly visits to the classroom involved observations. The observations revealed that students were praised upon successful completion of a task.

Analysis of process objective five

Objective five during the second year (final 18 weeks) of the practicum was to:

5. Provide each student with concrete, diagrammatic, abstract, as well as individual, small-group, and large-group learning experiences as reported by the teachers and verified by the practitioner.

The practitioner reviewed students' folders during monthly classroom visitations. The review of prescriptions and classroom observations revealed that students were provided with the stated activities and learning experiences.

Analysis of process objective six

Objective six during the second year (final 18 weeks) of the practicum was to:

6. Provide for constant assessment of student attainment of the stated objectives and provide methods for monitoring and reacting to results of this assessment as reported by the teachers and verified by the practitioner.

The practitioner checked the students' folders during the monthly visits. The folder checks revealed that student prescriptions and student profiles were constantly updated in reaction to student assessment.

Analysis of process objective seven

Objective seven during the second year (final 18 weeks) of the practicum was to:

7. Provide the traditional mathematics teachers with the names of the participants (IMLS students) enrolled in the traditional high school mathematics class as reported by the teachers and verified by the practitioner.

The IMLS teachers provided the practitioner with a copy of the student list that was provided the traditional teachers.

Analysis of process objective eight

Objective eight during the second year (final 18 weeks) of the practicum was to:

8. Provide directions to traditional mathematics teachers for returning participants (IMLS students) to the laboratory when skills deficiencies are identified as reported by the teachers and verified by the practitioner.

The IMLS teachers provided directions for returning IMLS students to the laboratory with the list of identified IMLS students provided the traditional mathematics teachers and the practitioner.

Analysis of process objective nine

Objective nine during the second year (final 18 weeks) of the practicum was to:

9. Return participants (IMLS students) to the traditional mathematics class when the skills deficiencies are corrected as reported by the teachers and verified by the practitioner.

The practitioner checked the students' prescriptions to verify the mastery of skills deficiencies of students returned to the traditional classes.

Evaluation of the Achievement of Outcome Objectives

Analysis of the Outcome Data for the First Year

The Metropolitan Mathematics Achievement Post-Test was administered to the participants on June 8, 1978. The results of this post-test were compared to the results of the pre-test. Comparison of the eighth and ninth grade (first year) attendance records were made at that time. The results were recorded in the following analyses. (See Appendix A, Pages 82-85.)

Analysis of data, objective one

Objective one during the first thirty-six weeks of the practicum for each participant is listed below. The actual post-test scores are also listed.

1. Computational skills grade equivalent scores of identified students will increase from pre-test scores listed to expected post-test

scores listed, based on the Metropolitan Mathematics Achievement Test:

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score	Actual Post-Test Score
1-1	1	81	3.6	4.3	5.5
1-2	1	101	3.6	4.4	8.5
1-3	1	108	3.6	4.5	8.5
1-4	1	83	4.1	4.8	5.0
1-5	2	95, 101	4.3	5.1	5.6, 7.3
1-6	2	106, 106	4.3	5.2	7.3, 7.3
1-7	2	81, 89	4.6	5.3	5.0, 8.1
1-8	2	96, 97	4.6	5.4	8.1, 8.1
1-9	3	103, 104, 105	4.6	5.5	7.9, Trans., 7.9
1-10	2	81, 85	4.8	5.5	Trans., Trans.
1-11	1	101	5.0	5.8	7.3
1-12	1	108	5.0	5.9	7.9
1-13	1	109	5.1	6.0	9.9
1-14	4	106, 108, 110, 111	5.3	6.2	8.5, 9.6, 9.6, 9.6
1-15	4	102, 103, 107, 107	5.5	6.4	6.7, 8.3, 8.3, 8.1
1-16	1	84	5.7	6.5	8.8
1-17	4	97, 97, 101, 101	5.7	6.6	8.8, 8.8, 7.9, 8.8
1-18	5	103, 103, 104, 104, 109	5.7	6.7	8.3, 8.1, 8.3, 8.1, 7.9
1-19	1	86	6.0	6.8	8.1
1-20	1	101	6.0	6.9	7.9
1-21	3	106, 107, 110	6.0	7.0	8.8, 8.8, 9.6
1-22	1	111	6.1	7.1	9.6
1-23	3	98, 100, 101	6.2	7.1	8.8, 9.6, 8.5
1-24	6	103, 105, 106, 107, 109, 109	6.2	7.2	Trans., 7.9, 8.1, 9.2, 9.6, 9.6
1-25	1	86	6.5	7.3	8.1
1-26	1	91	6.5	7.4	7.9
1-27	2	105, 109	6.5	7.5	9.2, 9.6

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score	Actual Post-Test Score
1-28	2	86, 89	6.7	7.5	8.8, 7.7
1-29	2	93, 98	6.7	7.6	8.1, 7.7
1-30	4	102, 104, 108, 108	6.7	7.7	9.2, 9.6, 9.2, 8.1
1-31	1	106	6.8	7.8	9.6
1-32	1	83	6.9	7.7	7.9
1-33	3	103, 110, 111	6.9	7.9	9.2, 9.6, 9.6
1-34	3	103, 105, 109	7.1	8.1	9.2, 8.8, 9.2
1-35	1	107	7.7	8.8	9.2
1-36	1	110	7.9	9.0	Trans.

Analysis of the Metropolitan Mathematics Achievement Pre- and Post-Test scores in computation skills revealed that 69 of the identified students pre-tested increased their grade equivalent scores to or above the expected post-test scores. Five of the pre-tested students transferred during the year. The 70 students who remained with the program needed to increase their pre-test scores to the expected post-test scores to meet the objective.

Analysis of data, objective two

Objective two during the first thirty-six weeks of the practicum for each participant is listed below. The actual post-test scores are also listed.

2. Concept skills grade equivalent scores of identified students will increase from pre-test scores listed to expected post-test scores listed, based on the Metropolitan Mathematics Achievement Test:

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score	Actual Post-Test Score
2-1	1	101	3.6	4.4	4.8
2-2	1	108	3.6	4.5	6.5

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score	Actual Post-Test Score
2-3	1	97	3.7	4.5	5.1
2-4	2	89, 89	3.8	4.5	5.1, 6.1
2-5	2	96, 98	3.8	4.6	5.1, 6.1
2-6	1	83	4.0	4.7	4.8
2-7	1	102	4.0	4.9	6.5
2-8	1	86	4.2	4.9	5.1
2-9	1	101	4.2	5.0	6.5
2-10	4	103, 105, 107, 106	4.2	5.1	Trans., 6.5, 8.1, 8.1
2-11	1	81	4.4	5.1	5.7
2-12	2	95, 100	4.4	5.2	6.1, 9.7
2-13	4.	108, 108, 109, 110	4.4	5.3	6.5, 9.7, 9.7, 9.7
2-14	1	103	4.6	5.5	6.1
2-15	2	81, 86	4.7	5.4	4.8, 5.1
2-16	1	98	4.7	5.5	5.1
2-17	5	103, 104, 110, 106, 109	4.7	5.6	5.7, Trans., Trans., 5.1, 9.7
2-18	1	93	4.8	5.6	6.5
2-19	7	107, 105, 104, 107, 102, 103, 106	4.8	5.7	6.9, 7.7, 6.1, 6.9, 5.3, 9.3, 7.7
2-20	2	101, 101	5.1	5.9	5.7, 4.8
2-21	3	103, 108, 110	5.1	6.0	9.1, 9.7, 9.7
2-22	1	84	5.3	6.0	6.3
2-23	3	97, 101, 101	5.3	6.1	6.3, 6.3, 6.3
2-24	3	107, 107, 109	5.3	6.2	9.1, 5.7, 8.7
2-25	3	105, 106, 109	5.6	6.6	9.1, 9.7, 9.7
2-26	2	81, 85	5.7	6.5	Trans., Trans.
2-27	1	106	5.7	6.7	9.1
2-28	1	83	6.1	6.9	7.5
2-29	1	91	6.1	7.0	7.5
2-30	3	106, 108, 109	6.1	7.1	9.1, 9.1, 8.7
2-31	1	97	6.3	7.2	6.9
2-32	2	103, 111	6.3	7.3	8.5, 9.7

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score	Actual Post-Test Score
2-33	1	86	6.5	7.3	8.7
2-34	2	111, 104	6.5	7.5	9.7, 9.7
2-35	1	98	7.3	8.2	6.5
2-36	2	105, 109	7.3	8.3	8.7, 9.7
2-37	1	110	7.5	8.5	9.7
2-38	1	111	7.7	8.8	9.7
2-39	2	104, 103	7.9	9.0	9.1, 9.3

Analysis of the Metropolitan Mathematics Achievement Pre- and Post-Test scores in concept skills revealed that 60 of the identified students pre-tested increased their grade equivalent scores to or above the expected post-test scores. Five of the pre-tested students transferred during the year. The 70 students who remained with the program needed to increase their pre-test scores to the expected post-test scores to meet the objective.

Analysis of data, objective three

Objective three during the first thirty-six weeks of the practicum for each participant is listed below. The actual post-test scores are also listed.

3. Problem solving skills grade equivalent scores of identified students will increase from pre-test scores listed to expected post-test scores listed, based on the Metropolitan Mathematics Achievement Test:

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score	Actual Post-Test Score
3-1	2	84, 89	3.6	4.3	6.8, 4.3
3-2	5	95, 96, 97, 101, 101	3.6	4.4	8.5, 4.3, 6.8, 6.8, 7.5
3-3	4	102, 104, 106 108	3.6	4.5	5.6, 8.5, 8.5, 7.5

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score	Actual Post-Test Score
3-4	1	97	3.8	4.6	4.3
3-5	3	81, 83, 86	4.0	4.7	4.6, 7.5, 6.5
3-6	2	104, 105	4.0	4.9	Trans., 9.1
3-7	1	81	4.3	5.0	6.5
3-8	1	98	4.3	5.1	7.3
3-9	6	105, 105, 106, 107, 108, 108	4.3	5.2	7.5, 7.5, 9.1, 9.1, 9.8, 5.6
3-10	1	97	4.6	5.4	6.3
3-11	4	102, 103, 106, 110	4.6	5.5	9.1, 8.5, 7.5, Trans.
3-12	1	104	4.8	5.7	8.5
3-13	2	83, 86	5.1	5.8	4.6, 8.8
3-14	1	98	5.1	5.9	7.3
3-15	5	103, 103, 104, 107, 110	5.1	6.0	7.5, 7.0, 9.1, 8.5, 9.8
3-16	1	101	5.3	6.1	6.8
3-17	2	86, 89	5.4	6.1	6.5, 5.4
3-18	1	98	5.4	6.2	5.4
3-19	3	103, 105, 108	5.4	6.3	9.1, 8.1, 7.3
3-20	2	103, 110	5.5	6.4	9.1, 9.5
3-21	2	101, 101	5.6	6.5	7.0, 6.8
3-22	2	103, 111	5.6	6.6	Trans., 9.8
3-23	2	81, 85	6.0	6.8	Trans., Trans.
3-24	1	100	6.0	6.9	9.5
3-25	9	103, 106, 107, 107, 108, 109, 109, 111, 111	6.0	7.0	9.1, 9.1, 7.9, 9.1, 8.1, 9.8, 9.8, 9.8, 9.8
3-26	1	91	6.2	7.1	7.5
3-27	1	106	6.2	7.2	9.5
3-28	2	107, 109	6.3	7.3	8.5, 8.1
3-29	2	93, 101	6.5	7.4	7.3, 6.0
3-30	2	106, 109	6.5	7.5	8.5, 8.8
3-31	2	109, 110	6.8	7.8	9.8, 9.8
3-32	1	109	7.7	8.8	9.8

Analysis of the Metropolitan Mathematics Achievement Pre- and Post-Test scores in problem solving skills revealed that 62 of the identified students pre-tested increased their grade equivalent scores to or above the expected post-test scores. Five of the pre-tested students transferred during the year. The 70 students who remained with the program needed to increase their pre-test scores to the expected post-test scores to meet the objective.

Analysis of data, objective four

Objective four during the first thirty-six weeks of the practicum for each participant is listed below. The actual post-test scores are also listed.

4. Total skills grade equivalent scores of identified students will increase from pre-test scores listed to expected post-test scores listed, based on the Metropolitan Mathematics Achievement Test:

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score	Actual Post-Test Score
4-1	2	81, 81	3.6	4.3	6.0, 6.9
4-2	1	108	3.6	4.5	7.1
4-3	1	89	3.7	4.4	6.0
4-4	2	96, 97	3.7	4.5	6.0, 6.0
4-5	1	108	4.0	4.9	7.3
4-6	1	83	4.2	4.9	4.8
4-7	1	98	4.2	5.0	6.9
4-8	1	106	4.2	5.1	6.9
4-9	1	81	4.3	5.0	4.8
4-10	1	104	4.3	5.2	Trans.
4-11	1	101	4.5	5.3	6.4
4-12	2	105, 106	4.5	5.4	7.6, 7.6
4-13	1	101	4.6	5.4	7.3
4-14	2	103, 107	4.6	5.5	6.9, 9.0

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score	Actual Post-Test Score
4-15	1	102	4.7	5.6	6.0
4-16	2	106, 107	4.8	5.7	8.6, 8.6
4-17	1	101	4.9	5.7	6.4
4-18	2	105, 108	4.9	5.8	7.3, 9.8
4-19	1	94	5.1	5.8	7.3
4-20	2	97, 101	5.1	5.9	7.3, 7.3
4-21	2	86, 86	5.2	5.9	6.7, 6.7
4-22	3	102, 103, 104	5.2	6.1	8.1, 7.6, 7.6
4-23	1	89	5.3	6.0	6.6
4-24	1	98	5.3	6.1	6.6
4-25	2	109, 110	5.3	6.2	9.8, 9.8
4-26	3	103, 103, 107	5.4	6.3	Trans., 8.8, 7.6
4-27	2	81, 85	5.6	6.4	Trans., Trans.
4-28	1	100	5.6	6.5	9.5
4-29	2	97, 101	5.7	6.6	7.3, 7.3
4-30	4	106, 107, 108, 111	5.7	6.7	8.8, 8.0, 7.6, 9.8
4-31	1	83	5.9	6.7	7.6
4-32	1	101	5.9	6.8	6.8
4-33	4	105, 103, 104, 109	5.9	6.9	9.0, 8.2, 8.2, 8.1
4-34	1	93	6.0	6.9	7.3
4-35	5	103, 103, 109, 110, 110	6.0	7.0	9.2, 8.8, 9.8, 9.5, Trans.
4-36	1	86	6.2	7.0	8.8
4-37	1	98	6.2	7.1	7.8
4-38	4	104, 106, 108, 109	6.2	7.2	9.5, 9.5, 8.8, 9.8
4-39	1	91	6.4	7.3	7.6
4-40	4	105, 106, 109, 111	6.4	7.4	8.6, 8.2, 9.8, 9.8
4-41	4	107, 109, 110, 111	6.6	7.6	8.8, 8.6, 9.8, 9.8

Analysis of the Metropolitan Mathematics Achievement Pre- and Post-Test scores in total skills revealed that 68 of the identified

students pre-tested increased their grade equivalent scores to or above the expected post-test scores. Five of the pre-tested students transferred during the year. The 70 students who remained with the program needed to increase their pre-test scores to the expected post-test scores to meet the objective.

Analysis of data, objective five

Objective five during the first thirty-six weeks of the practicum for each participant is listed below.

5. Student attendance in mathematics will improve by 10 percent as indicated by analysis of the eighth grade attendance records compared to the ninth grade attendance records.

The total eighth grade absences, ninth grade (first year) absences, and percent of reduction for each student are found in Appendix A, Table 5, Pages 88-89.

Analysis of the attendance records revealed that 70 students improved their attendance in IMLS classes by a minimum of 10 percent. Five of the 75 IMLS students transferred during the year. The 70 students who remained with the program needed to improve their attendance by 10 percent to meet the objective.

Analysis of the Outcome Data for the Second Year

The Metropolitan Mathematics Achievement Post-Test was administered to the participants on January 26, 1979. The results of the June 8, 1978, post-test (pre-test for the second year) were compared to the January 26, 1979, post-test. Comparison of the first year and second year attendance records were made at that time. The results were recorded in the following analyses. (See Appendix A, Pages 84-87.)

Analysis of data, objective one

Objective one during the second year (final 18 weeks) of the practicum for each participant is listed below. The actual post-test scores are also listed.

1. Computational skills grade equivalent scores of identified students will increase from pre-test scores listed to expected post-test scores listed, based on the Metropolitan Mathematics Achievement Test:

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score	Actual Post-Test Score
1-1	2	81, 83	5.0	5.35	5.5, 6.5
1-2	1	81	5.5	5.85	6.3
1-3	1	95	5.6	6.00	6.7
1-4	1	102	6.7	7.20	8.1
1-5	2	101, 101	7.3	7.75	8.8, 8.5
1-6	2	106, 106	7.3	7.80	8.3, 8.5
1-7	1	89	7.7	8.15	7.9
1-8	1	98	7.7	8.20	9.2
1-9	1	83	7.9	8.35	8.8
1-10	3	91, 101, 101	7.9	8.40	8.7, 8.3, 8.8
1-11	5	103, 105, 105, 108, 109	7.9	8.45	8.8, 8.8, 8.8, 8.8, 8.6
1-12	3	86, 86, 89	8.1	8.55	9.2, 8.8, 6.7
1-13	3	93, 96, 97	8.1	8.60	9.2, 8.1, 8.6
1-14	5	103, 104, 106, 107, 108	8.1	8.65	9.2, 9.2, 8.8, 8.8, 9.2
1-15	4	103, 103, 104, 107	8.3	8.85	9.2, 9.2, 9.2, 9.2
1-16	2	98, 101	8.5	9.00	9.2, 9.2
1-17	2	106, 108	8.5	9.05	9.2, 9.2
1-18	2	84, 86	8.8	9.25	9.6, 9.6
1-19	4	97, 97, 98, 101	8.8	9.30	9.6, 9.6, 9.6, 9.6
1-20	3	105, 106, 107	8.8	9.35	9.9, 9.6, 9.6

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score	Actual Post-Test Score
1-21	8	102, 103, 103, 105, 107, 107, 108, 109	9.2	9.75	9.9, 9.6, 9.9, 9.9, 9.9, 9.9, 9.9, 9.9

Analysis of the Metropolitan Mathematics Achievement Pre- and Post-Test scores in computation skills revealed that 51 of the identified students pre-tested increased their grade equivalent scores to or above the expected post-test scores. Five students transferred during the first year of the practicum. In addition, fourteen students scored at least 9.5 grade equivalents on the first year total skills post-test and did not return to the program. The 56 pre-tested students who remained in the program needed to increase their pre-test scores to the expected post-test scores to meet the objective.

Analysis of data, objective two

Objective two during the second year (final 18 weeks) of the practicum for each participant is listed below. The actual post-test scores are also listed.

2. Concept skills grade equivalent scores of identified students will increase from pre-test scores listed to expected post-test scores listed, based on the Metropolitan Mathematics Achievement Test:

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score	Actual Post-Test Score
2-1	2	81, 83	4.8	5.15	5.1, 5.9
2-2	2	101, 101	4.8	5.20	8.3, 7.9
2-3	3	86, 86, 89	5.1	5.45	8.7, 8.3, 6.9
2-4	3	96, 97, 98	5.1	5.50	7.9, 7.3, 8.5
2-5	1	106	5.1	5.55	7.7
2-6	1	102	5.3	5.75	7.9

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score	Actual Post-Test Score
2-7	1	81	5.7	6.10	6.5
2-8	1	101	5.7	6.15	8.9
2-9	2	103, 107	5.7	6.20	7.3, 7.9
2-10	1	89	6.1	6.50	6.7
2-11	2	95, 98	6.1	6.55	6.9, 8.7
2-12	3	103, 104, 108	6.1	6.60	8.7, 7.3, 7.9
2-13	1	84	6.3	6.70	9.3
2-14	3	97, 101, 101	6.3	6.75	8.7, 8.1, 8.9
2-15	3	93, 98, 101	6.5	6.95	8.7, 8.9, 7.9
2-16	4	102, 105, 108, 108	6.5	7.00	9.9, 8.7, 8.7, 8.5
2-17	1	97	6.9	7.35	9.3
2-18	1	107	6.9	7.40	9.3
2-19	1	83	7.5	7.90	8.7
2-20	1	91	7.5	7.95	8.5
2-21	2	105, 106	7.7	8.25	8.7, 8.7
2-22	2	106, 107	8.1	8.65	8.7, 9.3
2-23	1	103	8.5	9.05	9.1
2-24	1	86	8.7	9.15	8.7
2-25	3	105, 109, 109	8.7	9.25	9.5, 9.7, 9.7
2-26	7	103, 104, 105, 106, 106, 107, 108	9.1	9.65	9.9, 9.9, 9.9, 9.9, 9.9, 9.9, 9.9
2-27	3	103, 103, 107	9.3	9.85	9.7, 9.7, 9.9

Analysis of the Metropolitan Mathematics Achievement Pre- and Post-Test scores in concept skills revealed that 52 of the identified students pre-tested increased their grade equivalent scores to or above the expected post-test scores. Five students transferred during the first year of the practicum. In addition, fourteen students scored at least 9.5 grade equivalents on the first year total skills post-test and did not return to the program. The 56 pre-tested students who remained

in the program needed to increase their pre-test scores to the expected post-test scores to meet the objective.

Analysis of data, objective three

Objective three during the second year (final 18 weeks) of the practicum for each participant is listed below. The actual post-test scores are also listed.

3. Problem solving skills grade equivalent scores of identified students will increase from pre-test scores listed to expected post-test scores listed, based on the Metropolitan Mathematics Achievement Test:

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score	Actual Post-Test Score
3-1	1	89	4.3	4.65	7.1
3-2	2	96, 97	4.3	4.70	7.7, 7.0
3-3	2	81, 83	4.6	4.95	5.1, 5.6
3-4	1	89	5.4	5.75	6.3
3-5	1	98	5.4	5.80	8.8
3-6	2	102, 108	5.6	6.10	7.5, 7.5
3-7	1	101	6.0	6.45	7.9
3-8	1	97	6.3	6.75	9.2
3-9	3	81, 86, 86	6.5	6.90	6.5, 8.5, 8.5
3-10	1	84	6.8	7.20	8.9
3-11	4	97, 101, 101, 101	6.8	7.25	8.5, 7.9, 8.8, 8.4
3-12	1	101	7.0	7.45	7.5
3-13	1	103	7.0	7.50	8.5
3-14	3	93, 98, 98	7.3	7.75	8.5, 9.5, 7.9
3-15	1	108	7.3	7.80	9.9
3-16	1	83	7.5	7.90	8.5
3-17	2	91, 101	7.5	7.95	8.7, 7.5
3-18	5	103, 105, 105, 106, 108	7.5	8.00	8.8, 8.5, 8.5, 7.9, 8.5

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score	Actual Post-Test Score
3-19	1	107	7.9	8.45	9.5
3-20	3	105, 108, 109	8.1	8.65	9.5, 8.8, 9.5
3-21	1	95	8.5	9.00	7.1
3-22	7	103, 104, 104, 106, 106, 107, 107	8.5	9.05	9.1, 9.2, 9.5, 9.1, 8.5, 8.5, 9.9
3-23	1	86	8.8	9.25	8.8
3-24	1	109	8.8	9.35	9.5
3-25	9	102, 103, 103, 103, 105, 106, 106, 107, 107	9.1	9.65	9.9, 9.9, 9.8, 9.5, 9.9, 9.9, 9.8, 9.9, 9.8

Analysis of the Metropolitan Mathematics Achievement Pre- and Post-Test scores in problem solving skills revealed that 48 of the identified students pre-tested increased their grade equivalent scores to or above the expected post-test scores. Five students transferred during the first year of the practicum. In addition, fourteen students scored at least 9.5 grade equivalents on the first year total skills post-test and did not return to the program. The 56 pre-tested students who remained in the program needed to increase their pre-test scores to the expected post-test scores to meet the objective.

Analysis of data, objective four

Objective four during the second year (final 18 weeks) of the practicum for each participant is listed below. The actual post-test scores are also listed.

4. Total skills grade equivalent scores of identified students will increase from pre-test scores listed to expected post-test scores listed, based on the Metropolitan Mathematics Achievement Test:

Item	Number of Students	I.Q.	Pre-Test Score	Expected Post-Test Score	Actual Post-Test Score
4-1	2	81, 83	4.8	5.15	5.2, 5.9
4-2	2	81, 89	6.0	6.40	6.4, 6.9
4-3	2	96, 97	6.0	6.45	7.8, 7.6
4-4	1	102	6.0	6.50	7.8
4-5	2	101, 101	6.4	6.85	8.2, 8.2
4-6	1	89	6.6	7.00	6.9
4-7	1	98	6.6	7.05	8.9
4-8	2	86, 86	6.7	7.10	8.8, 8.5
4-9	1	101	6.8	7.25	8.0
4-10	1	98	6.9	7.35	8.5
4-11	3	103, 106, 108	6.9	7.40	7.8, 8.0, 8.2
4-12	1	95	7.1	7.55	6.9
4-13	1	84	7.3	7.70	8.8
4-14	5	93, 97, 97, 101, 101	7.3	7.75	8.8, 9.2, 8.8, 9.0, 7.8
4-15	3	105, 109, 108	7.3	7.80	8.6, 9.2, 8.6
4-16	1	83	7.6	8.05	8.6
4-17	1	91	7.6	8.10	8.6
4-18	6	103, 104, 105, 106, 107, 108	7.6	8.15	9.0, 8.8, 8.6, 8.4, 8.4, 9.0
4-19	1	98	7.8	8.30	9.0
4-20	1	107	8.0	8.55	9.5
4-21	2	102, 109	8.1	8.65	8.9, 9.5
4-22	3	103, 104, 106	8.2	8.75	9.2, 9.5, 9.0
4-23	4	105, 106, 107, 109	8.6	9.15	9.5, 9.2, 9.5, 9.5
4-24	1	86	8.8	9.25	9.5
4-25	5	103, 103, 106, 107, 108	8.8	9.35	9.5, 9.5, 9.5, 9.9, 9.9
4-26	2	105, 107	9.0	9.55	9.9, 9.5
4-27	1	103	9.2	9.75	9.8

Analysis of the Metropolitan Mathematics Achievement Pre- and Post-Test scores in total skills revealed that 53 of the identified students pre-tested increased their grade equivalent scores to or above the expected post-test scores. Five students transferred during the first year of the practicum. In addition, fourteen students scored at least 9.5 grade equivalents on the first year total skills post-test and did not return to the program. The 56 pre-tested students who remained in the program needed to increase their pre-test scores to the expected post-test scores to meet the objective.

Analysis of data, objective five

Objective five during the second year (final 18 weeks) of the practicum for each participant is listed below.

5. Student attendance in mathematics will improve by 5 percent as indicated by analysis of the attendance in the first year of the program compared to the recorded extrapolated attendance in the 18 weeks of the second year as reported on the attendance records.

Analysis of the attendance records revealed that 53 IMLS students improved their attendance in mathematics by a minimum of 5 percent. Fifty-six students needed to improve their attendance by 5 percent to meet the objective. (See Appendix A, Table 6, Pages 90-91.)

Summary of Findings

First Year of Practicum

Objective One: The Metropolitan Mathematics Achievement Pre- and Post-Test scores for those students who completed the first year of the program revealed that 69 (98.6 percent) of the identified students pre-tested on computation skills increased their grade equivalent scores to

or above the expected post-test scores. The students' post-test scores revealed that 98.6 percent met the objective. Therefore, the practicum treatment for objective one was considered to be successful.

Objective Two: The Metropolitan Mathematics Achievement Pre- and Post-Test scores for those students who completed the first year of the program revealed that 60 (85.7 percent) of the identified students pre-tested on concept skills increased their grade equivalent scores to or above the expected post-test scores. The students' post-test scores revealed that 85.7 percent met the objective. Therefore, the practicum treatment for objective two was considered to be successful.

Objective Three: The Metropolitan Mathematics Achievement Pre- and Post-Test scores for those students who completed the first year of the program revealed that 62 (88.6 percent) of the identified students pre-tested on problem solving skills increased their grade equivalent scores to or above the expected post-test scores. The students' post-test scores revealed that 88.6 percent met the objective. Therefore, the practicum treatment for objective three was considered to be successful.

Objective Four: The Metropolitan Mathematics Achievement Pre- and Post-Test scores for those students who completed the first year of the program revealed that 68 (97.1 percent) of the identified students pre-tested on total skills increased their grade equivalent scores to or above the expected post-test scores. The students' post-test scores revealed that 97.1 percent met the objective. Therefore, the practicum treatment for objective four was considered to be successful.

Objective Five: An analysis of attendance reports for the eighth grade compared to attendance reports for the ninth grade (the first year of the practicum) revealed that 70 (100 percent) of the participating

students improved their attendance in IMLS classes by at least 10 percent. The students' improved attendance met the objective. Therefore, the practicum treatment for objective five was considered to be successful.

The findings for each objective revealed that all the students did not reach the expected outcomes during the first year of the practicum; however, each objective was met by 85.7 to 100 percent of the participants. Therefore, the overall practicum treatment for the objectives was considered to be successful.

Second Year of Practicum

Objective One: The Metropolitan Mathematics Achievement Pre- and Post-Test scores for those students who completed the second year of the program (final 18 weeks) revealed that 51 (91.1 percent) of the identified students pre-tested on computation skills increased their grade equivalent scores to or above the expected post-test scores. The students' post-test scores revealed that 91.1 percent met the objective. Therefore, the practicum treatment for objective one was considered to be successful.

Objective Two: The Metropolitan Mathematics Achievement Pre- and Post-Test scores for those students who completed the second year of the program (final 18 weeks) revealed that 52 (92.9 percent) of the identified students pre-tested on concept skills increased their grade equivalent scores to or above the expected post-test scores. The students' post-test scores revealed that 92.9 percent met the objective. Therefore, the practicum treatment for objective two was considered to be successful.

Objective Three: The Metropolitan Mathematics Achievement Pre- and Post-Test scores for those students who completed the second year of the program (final 18 weeks) revealed that 48 (85.7 percent) of the identified students pre-tested on problem solving skills increased their

grade equivalent scores to or above the expected post-test scores. The students' post-test scores revealed that 85.7 percent met the objective. Therefore, the practicum treatment for objective three was considered to be successful.

Objective Four: The Metropolitan Mathematics Achievement Pre- and Post-Test scores for those students who completed the second year of the program (final 18 weeks) revealed that 53 (94.6 percent) of the identified students pre-tested on total skills increased their grade equivalent scores to or above the expected post-test scores. The students' post-test scores revealed that 94.6 percent met the objective. Therefore, the practicum treatment for objective four was considered to be successful.

Objective Five: An analysis of attendance reports for the ninth grade (first year of the practicum) compared to extrapolated attendance reports for the second year (final 18 weeks) revealed that 53 (94.6 percent) of the participating students improved their attendance in mathematics by at least 5 percent. Therefore, the practicum treatment for objective five was considered to be successful.

The findings for each objective revealed that all the students did not reach the expected outcomes during the second year of the practicum; however, each objective was met by 85.7 to 94.6 percent of the participants. Therefore, the overall practicum treatment for the objectives was considered to be successful.

CHAPTER VII

INSTITUTIONALIZING AND FURTHER APPLICATIONS OF THE PROGRAM

A copy of the interim report of this practicum was made available to the Director of Secondary Education of the South Bend Community School Corporation at the end of the first year of the program. A copy of this final report will also be made available to the Director of Secondary Education. As a result of the success demonstrated by the program in the first year, as reflected in the interim report, and the success of the program in the second year, as demonstrated in this report, a South Bend Community School Corporation curriculum code number will be assigned to the IMLS course. It will become a part of the South Bend Community School Corporation's list of course offerings.

In the fall of 1978, the Individualized Mathematics Laboratory System's teachers began orientation sessions for the mathematics teachers in three of the South Bend Community School Corporation's middle schools. Interested middle school mathematics teachers visited Washington High School for orientation sessions on the individualized mathematics program. The Washington High School IMLS teachers also visited middle schools by invitation to conduct orientation sessions on the Individualized Mathematics Laboratory System. These sessions will continue. The middle school mathematics teachers will visit the Washington High School program and/or the Washington High School IMLS staff will visit the interested middle schools, when requested by the middle schools' staffs.

There have been various inquiries concerning the program from school districts within the state of Indiana and from school districts in the state of Michigan. A copy of this report will be made available to those interested school districts. A copy of a letter from a school district in Michigan requesting information concerning this program is found in Appendix E, Page 149.

A copy of this report will also be sent to Mr. Donald Dake, Superintendent of Schools, South Bend Community School Corporation, since this report might prove useful in planning other individualized programs. The practitioner is also proud of the diligent work invested in the program by the students and teachers that resulted in the program exceeding the practicum objectives.

APPENDICES

APPENDIX A

TABLE 1

METROPOLITAN MATHEMATICS ACHIEVEMENT
PRE-TEST TOTAL SKILLS GRADE EQUIVALENT RANGE

Grade Equivalent	Number of Students	I.Q. Ranges
3.6 - 4.6	18	81 - 107
4.7 - 5.7	30	81 - 111
5.8 - 6.8	27	83 - 111
6.9 - 7.9	0	———

TABLE 2

METROPOLITAN MATHEMATICS ACHIEVEMENT
TEST GRADE EQUIVALENT SCORES, MATHEMATICS
PERIOD ABSENCES, AND I.Q. AT THE END OF THE EIGHTH GRADE

Student Numbers	Computation Skills	Concept Skills	Problem Solving	Total Skills	Absences	I.Q.
1	4.8	5.7	6.0	5.6	31	81
2	6.9	6.1	4.0	5.9	34	83
3	5.7	4.6	4.6	5.2	35	103
4	6.2	5.6	6.8	6.2	29	109
5	7.9	4.7	4.6	6.0	31	110
6	6.2	6.1	6.5	6.4	25	106
7	4.1	4.0	5.1	4.2	39	83
8	6.9	5.1	5.5	6.0	27	110
9	6.2	4.2	5.6	5.4	33	103
10	4.6	4.7	4.0	4.3	36	104
11	5.7	4.8	4.8	5.2	33	104
12	6.2	4.8	6.0	5.7	29	107
13	5.7	5.3	6.5	5.9	30	101
14	5.7	6.3	5.4	5.9	33	103
15	6.0	4.2	5.4	5.2	34	86
16	6.2	5.1	5.6	5.7	29	101
17	5.7	5.3	3.6	5.1	31	84
18	6.2	4.4	6.0	5.6	30	100
19	4.3	4.7	3.6	4.2	37	106
20	5.7	7.9	3.6	5.9	31	104
21	5.5	5.3	5.1	5.4	34	107
22	5.3	5.7	6.0	5.7	30	106
23	6.5	4.7	4.0	5.2	33	86
24	6.7	4.8	6.5	6.0	28	93
25	6.5	7.3	5.4	6.4	2[illegible]	105
26	6.1	6.3	5.6	6.6	25	111
27	6.7	4.0	4.6	5.2	35	102
28	6.7	6.1	5.4	6.2	27	108
29	6.9	6.5	6.0	5.7	30	111
30	5.5	4.8	3.6	4.7	38	102
31	7.1	5.6	4.0	5.9	33	105
32	5.3	7.5	6.8	6.6	22	110
33	5.3	5.1	4.3	4.9	34	108
34	5.0	3.6	5.6	4.5	34	101
35	6.7	3.8	5.4	5.3	32	98

TABLE 2—Continued

Student Numbers	Computation Skills	Concept Skills	Problem Solving	Total Skills	Absences	I.Q.
36	5.7	6.3	4.6	5.7	27	97
37	6.7	4.4	6.0	5.7	31	108
38	5.3	7.7	6.0	6.4	26	111
39	6.0	4.2	4.3	4.8	36	107
40	7.1	6.1	6.3	6.6	23	109
41	5.7	5.3	3.6	5.1	33	101
42	3.6	4.4	4.3	3.6	40	81
43	6.7	6.5	5.1	6.2	28	86
44	7.7	5.3	6.3	6.6	22	107
45	6.2	4.7	7.7	6.4	26	109
46	5.0	3.6	3.6	4.0	37	108
47	6.5	7.3	6.0	6.0	24	109
48	5.7	5.3	6.5	5.9	34	109
49	7.1	7.9	5.1	6.0	30	103
50	4.6	3.8	3.6	3.7	36	96
51	4.3	4.8	4.6	4.5	37	106
52	6.0	4.4	5.1	5.3	32	110
53	6.2	7.3	5.1	6.2	29	98
54	5.5	4.8	6.0	5.4	31	103
55	6.0	4.2	3.6	4.6	35	101
56	6.2	4.2	4.3	4.9	35	105
57	3.6	4.4	4.3	3.6	38	108
58	4.6	4.7	5.1	4.6	35	103
59	4.6	3.7	3.8	3.7	36	97
60	4.6	4.8	4.3	4.5	33	105
61	5.1	4.4	6.0	5.3	32	109
62	5.5	4.8	6.0	4.6	38	107
63	6.0	4.2	4.3	4.8	36	106
64	6.7	6.5	5.1	6.2	27	104
65	6.5	6.1	6.2	6.4	26	91
66	6.8	5.6	6.2	6.2	28	106
67	6.9	5.1	5.5	6.0	33	103
68	4.6	3.8	3.6	3.7	39	89
69	4.3	4.4	3.6	3.6	40	95
70	4.6	4.7	4.0	4.3	33	81
71	6.7	3.8	5.4	5.3	32	89
72	3.6	4.7	4.3	4.2	34	98
73	4.3	5.1	5.3	4.9	34	101
74	5.7	5.3	3.6	5.1	33	97
75	4.8	5.7	6.0	5.6	32	85

TABLE 3

METROPOLITAN MATHEMATICS ACHIEVEMENT
TEST GRADE EQUIVALENT SCORES, IMLS ABSENCES,
AND I.Q. AT THE END OF THE FIRST YEAR OF THE PRACTICUM

Student Numbers	Computation Skills	Concept Skills	Problem Solving	Total Skills	Absences	I.Q.
1	Transferred					
2	7.9	7.5	7.5	7.6	22	83
3	8.3	6.1	8.5	7.6	24	103
4	9.6	9.7	9.8	9.8	15	109
5	Transferred					
6	8.1	9.1	8.5	8.2	14	106
7	5.0	4.8	4.6	4.8	30	83
8	9.6	9.7	9.5	9.5	13	110
9	Transferred					
10	Transferred					
11	8.3	6.1	8.5	7.6	19	104
12	9.2	6.9	7.9	8.0	21	107
13	7.9	6.3	6.0	6.8	27	101
14	8.1	8.5	9.1	8.2	19	103
15	8.1	5.1	6.5	6.7	25	86
16	8.5	5.7	7.0	7.3	25	101
17	8.8	6.3	6.8	7.3	21	84
18	9.6	9.7	9.5	9.5	11	100
19	7.3	5.1	8.5	6.9	17	106
20	8.1	9.1	8.5	8.2	13	104
21	8.1	5.7	8.5	7.6	10	107
22	8.5	9.1	9.1	8.8	9	106
23	8.1	5.1	6.5	6.7	21	86
24	8.1	6.5	7.3	7.3	15	93
25	9.2	8.7	8.1	8.6	13	105
26	9.6	9.7	9.8	9.8	9	111
27	9.2	6.5	9.1	8.1	11	102
28	9.2	9.1	7.3	8.8	8	108
29	9.6	9.7	9.8	9.8	7	111
30	6.7	5.3	5.6	6.0	9	102
31	8.8	9.1	9.1	9.0	14	105
32	9.6	9.7	9.8	9.8	10	110
33	9.6	9.7	9.8	9.8	9	108
34	7.3	4.8	6.8	6.4	20	101
35	7.7	6.1	5.4	6.6	17	98

TABLE 3—Continued

Student Numbers	Computation Skills	Concept Skills	Problem Solving	Total Skills	Absences	I.Q.
36	8.8	6.9	6.3	7.3	20	97
37	8.1	6.5	8.1	7.6	21	108
38	9.6	9.7	9.8	9.8	8	111
39	8.8	8.1	9.1	8.6	11	107
40	9.2	8.7	8.1	8.6	12	109
41	8.8	6.3	6.8	7.3	16	101
42	5.5	5.7	6.5	6.0	20	81
43	8.8	8.7	8.8	8.8	8	86
44	9.2	9.1	8.5	8.8	11	107
45	9.6	9.7	9.8	9.8	9	109
46	7.9	6.5	7.5	7.3	19	108
47	9.6	9.7	9.8	9.8	8	109
48	7.9	8.7	8.8	8.1	10	109
49	9.2	9.3	7.5	8.8	14	103
50	8.1	5.1	4.3	6.0	17	96
51	7.3	7.7	7.5	7.6	22	106
52	9.6	9.7	9.8	9.8	17	110
53	8.8	6.5	7.3	7.8	18	98
54	8.3	9.3	9.1	8.8	14	103
55	7.9	6.5	7.5	7.3	23	103
56	7.9	6.5	7.5	7.3	17	105
57	8.5	6.1	5.6	6.9	18	108
58	7.9	5.7	7.0	6.9	23	103
59	8.1	5.1	4.3	6.0	25	97
60	7.9	7.7	7.5	7.6	18	105
61	9.9	9.7	9.8	9.8	7	109
62	8.3	9.3	9.1	9.0	9	107
63	8.8	8.1	9.1	8.6	11	106
64	9.6	9.7	9.1	9.5	8	104
65	7.9	7.5	7.5	7.6	15	91
66	9.6	9.7	9.5	9.5	8	106
67	9.2	9.1	9.1	9.2	11	103
68	8.1	5.1	4.3	6.0	18	89
69	5.6	6.1	8.5	7.1	17	95
70	5.0	4.8	4.6	4.8	29	81
71	7.7	6.1	5.4	6.6	23	89
72	8.5	5.1	7.3	6.9	19	98
73	7.3	4.8	6.8	6.4	21	101
74	8.8	6.3	6.8	7.3	14	97
75	Transferred					

TABLE 4

METROPOLITAN MATHEMATICS ACHIEVEMENT
TEST GRADE EQUIVALENT SCORES, IMLS ABSENCES,
AND I.Q. AT THE END OF THE SECOND YEAR OF THE PRACTICUM

Student Numbers	Computation Skills	Concept Skills	Problem Solving	Total Skills	Absences	I.Q.
1	Transferred					
2	8.8	8.7	8.5	8.6	5	83
3	9.2	8.7	9.1	9.0	4	103
*4						
5	Transferred					
6	8.8	9.9	9.1	9.0	3	106
7	6.5	5.9	5.6	5.9	6	83
*8						
9	Transferred					
10	Transferred					
11	9.2	7.3	9.2	8.8	5	104
12	9.9	9.3	9.5	9.5	3	107
13	8.8	8.1	7.9	8.0	6	101
14	9.2	9.1	9.9	9.2	3	103
15	9.2	8.7	8.5	8.8	5	86
16	9.2	8.9	8.8	8.8	6	101
17	9.6	9.3	8.9	9.2	4	84
*18						
19	8.3	7.7	8.5	8.0	5	106
20	9.2	9.9	9.5	9.5	3	104
21	8.8	7.9	8.5	8.4	3	107
22	9.2	9.9	9.9	9.5	2	106
23	8.8	8.3	8.5	8.5	6	86
24	9.2	8.7	8.5	8.8	5	93
25	9.9	9.5	9.5	9.5	3	105
*26						
27	9.9	9.1	9.9	9.5	3	102
28	9.9	9.9	9.9	9.9	2	108
*29						
30	8.1	7.9	7.5	7.8	3	102
31	9.9	9.9	9.9	9.9	1	105
*32						
*33						
34	8.8	8.3	7.9	[illegible].2	5	101
35	9.2	8.7	8.8	[illegible].9	6	98

*Student scored at least 9.5 on the total skills post-test for the first year of the program. Thus, he/she did not return to the program.

TABLE 4--Continued

Student Numbers	Computation Skills	Concept Skills	Problem Solving	Total Skills	Absences	I.Q.
36	9.6	9.3	9.2	9.2	4	97
37	9.2	8.7	8.8	9.0	5	108
*38						
39	9.6	9.3	9.9	9.5	3	107
40	9.9	9.7	9.5	9.5	3	109
41	9.6	8.9	8.8	9.0	4	101
42	6.3	6.5	6.5	6.4	7	81
43	9.6	9.7	9.5	9.5	2	86
44	9.9	9.9	9.9	9.9	2	107
*45						
46	8.8	8.5	8.5	8.6	3	108
*47						
48	8.3	8.7	8.8	8.6	5	109
49	9.6	9.7	8.8	9.2	4	103
50	8.1	7.9	7.7	7.8	6	96
51	8.5	8.7	7.9	8.4	6	106
*52						
53	9.6	8.9	8.5	9.0	5	98
54	9.2	9.9	9.5	9.5	3	103
55	8.3	7.9	7.5	7.8	7	101
56	8.8	8.7	8.5	8.6	9	105
57	9.2	7.9	7.5	8.2	6	108
58	8.8	7.3	7.5	7.8	8	103
59	8.6	7.3	7.0	7.6	9	97
60	8.5	8.7	8.5	8.6	6	105
*61						
62	9.2	9.7	9.8	9.5	3	107
63	9.6	8.7	9.8	9.2	5	106
*64						
65	8.7	8.5	8.7	8.6	2	91
*66						
67	9.9	9.9	9.8	9.8	1	103
68	8.8	7.1	6.8	7.5	6	89
69	6.7	6.9	7.1	6.9	9	95
70	5.5	5.1	5.1	5.2	12	81
71	7.9	6.7	6.3	6.9	10	89
72	9.2	8.5	7.9	8.5	6	98
73	8.5	7.9	8.4	8.2	7	101
74	9.6	8.7	8.5	8.8	5	97
75	Transferred					

TABLE 5

TOTAL STUDENT ABSENCES IN MATHEMATICS CLASSES
AT THE END OF THE EIGHTH GRADE, IN IMLS CLASSES
AT THE END OF THE FIRST YEAR, AND THE PERCENT OF REDUCTION

Student Numbers	Eighth Grade Absences	First Year Absences	Percent of Reduction
1	31	Transferred	
2	34	22	35%
3	35	24	31%
4	29	15	48%
5	31	Transferred	
6	25	14	44%
7	39	30	23%
8	27	13	52%
9	33	Transferred	
10	36	Transferred	
11	33	19	42%
12	29	21	28%
13	30	27	10%
14	33	19	42%
15	34	25	26%
16	29	25	14%
17	31	21	32%
18	30	11	63%
19	37	17	54%
20	32	13	58%
21	34	10	71%
22	30	9	70%
23	33	21	36%
24	28	15	46%
25	25	13	48%
26	25	9	64%
27	35	11	69%
28	27	8	70%
29	30	7	77%
30	38	9	76%
31	33	14	58%
32	22	10	55%
33	34	9	74%
34	34	20	41%
35	32	17	47%

TABLE 5—Continued

Student Numbers	Eighth Grade Absences	First Year Absences	Percent of Reduction
36	27	20	26%
37	31	21	32%
38	26	8	69%
39	36	11	69%
40	23	12	48%
41	33	16	52%
42	40	20	50%
43	28	8	71%
44	22	11	50%
45	26	9	65%
46	37	19	49%
47.	24	8	67%
48	34	10	71%
49	30	14	53%
50	36	17	53%
51	37	22	41%
52	32	17	47%
53	29	18	38%
54	31	14	55%
55	35	23	34%
56	35	17	51%
57	38	18	53%
58	35	23	34%
59	36	25	31%
60	33	18	45%
61	32	7	78%
62	38	9	76%
63	36	11	69%
64	27	8	70%
65	26	15	42%
66	28	8	71%
67	33	11	67%
68	39	18	54%
69	40	17	58%
70	33	29	12%
71	32	23	28%
72	34	19	44%
73	34	21	38%
74	33	14	58%
75	32	Transferred	

TABLE 6

TOTAL IMLS STUDENT ABSENCES IN THE IMLS CLASSES AT THE END OF THE FIRST YEAR, IN IMLS CLASSES AND OTHER MATHEMATICS CLASSES AT THE END OF THE SECOND YEAR, AND PERCENT OF REDUCTION

Student Numbers	First Year Absences	Second Year Absences		Percent of Reduction
		Actual	Extrapolated	
1	Transferred			
2	22	5	10	55%
3	24	4	8	67%
*4	15			
5	Transferred			
6	14	3	6	57%
7	30	6	12	60%
*8	13			
9	Transferred			
10	Transferred			
11	19	5	10	47%
12	21	3	6	71%
13	27	6	12	56%
14	19	3	6	68%
15	25	5	10	60%
16	25	6	12	52%
17	21	4	8	62%
*18	11			
19	17	5	10	41%
20	13	3	6	54%
21	10	3	6	40%
22	9	2	4	56%
23	21	6	12	43%
24	15	5	10	33%
25	13	3	6	54%
*26	9			
27	11	3	6	45%
28	8	2	4	50%
*29	7			
30	9	3	6	33%
31	14	1	2	86%
*32	10			
*33	9			
34	20	5	10	50%
35	17	6	12	29%

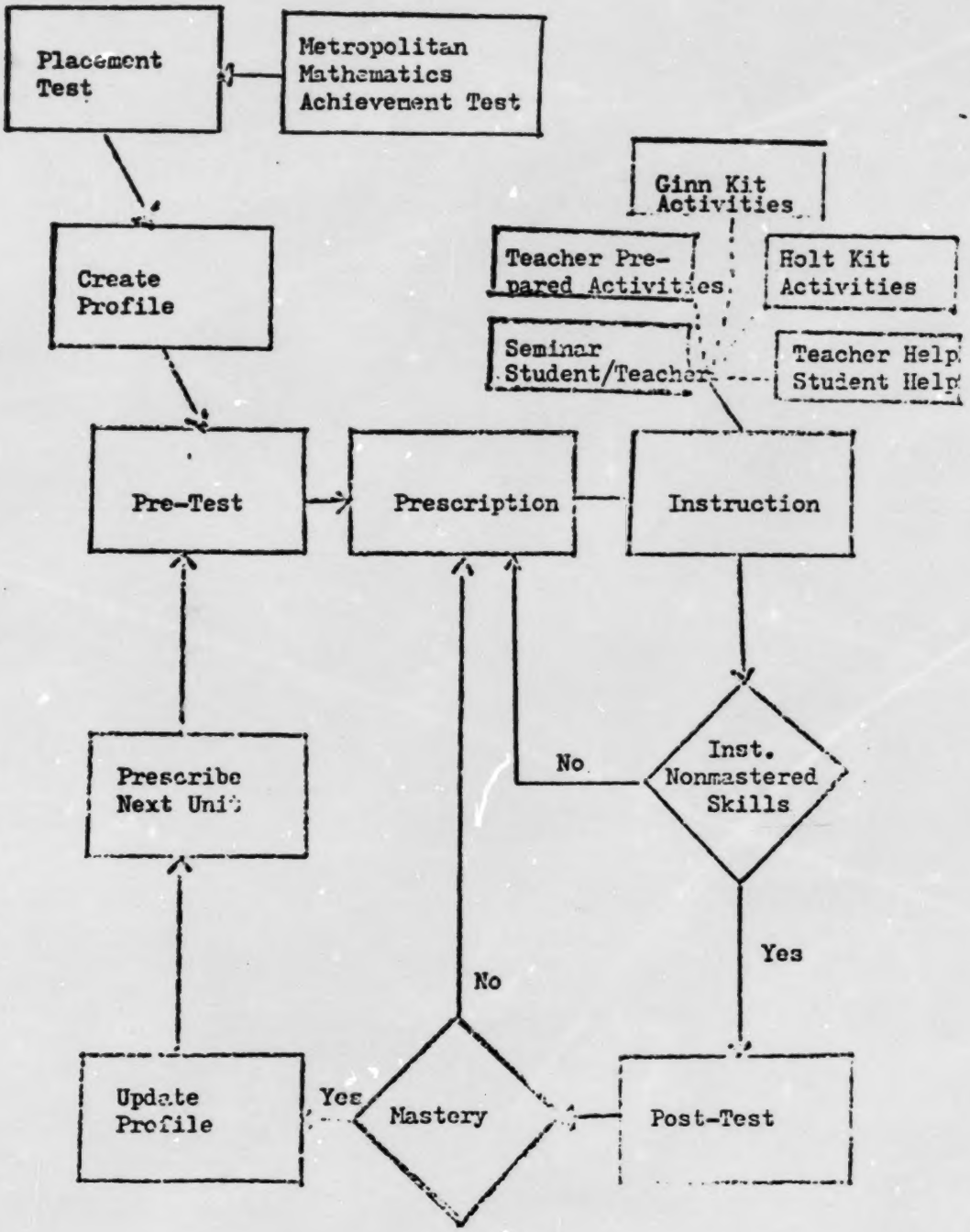
*Student scored at least 9.5 on the total skills post-test for the first year of the program. Thus, he/she did not return to the program.

TABLE 6—Continued

Student Numbers	First Year Absences	Second Year Absences		Percent of Reduction
		Actual	Extrapolated	
36	20	4	8	60%
37	21	5	10	52%
*38	8			
39	11	3	6	45%
40	12	3	6	50%
41	16	4	8	50%
42	20	7	14	30%
43	8	2	4	50%
44	11	2	4	64%
*45	9			
46	19	3	6	68%
*47	8			
48	10	5	10	0%
49	14	4	8	43%
50	17	6	12	29%
51	22	6	12	45%
*52	17			
53	18	5	10	44%
54	14	3	6	57%
55	23	7	14	39%
56	17	9	18	-6%
57	18	6	12	33%
58	23	8	16	30%
59	25	9	18	28%
60	18	6	12	33%
*61	7			
62	9	3	6	33%
63	11	5	10	9%
*64	8			
65	15	2	4	73%
*66	8			
67	11	1	2	82%
68	18	6	12	33%
69	17	9	18	-6%
70	29	12	24	17%
71	23	10	20	13%
72	19	6	12	37%
73	21	7	14	33%
74	14	5	10	29%
75	Transferred			

APPENDIX B

The DMLS Learning Cycle is described by this flow chart.



STUDENT PROFILE

Name_____ Period_____

	IV	V	VI	VII	VIII	IX	X	XI	XII
Numeration									
Rational Numbers									
Addition									
Subtraction									
Multiplication									
Division									
Fractions									
Applications									
Problem Solving									
Computation									
Measurement									
Geometry									
Pre-Algebra									

STUDENT PRESCRIPTION

Name_____ Period_____ Unit_____ Date_____

SKILL NO.		1	2	3	4	5	6	7	8	9	10	11
Pre-Test	Total	/	/	/	/	/	/	/	/	/	/	/
	Score											
Post-Test	Total	/	/	/	/	/	/	/	/	/	/	/
	Score											
Post-Test	Score											

PRESCRIPTION				RESULTS	
Date	Initial	Skill	Page	Total	Score

PRESCRIPTION				RESULTS	
Date	Initial	Skill	Page	Total	Score

STUDENT PROFILE
CORRELATION

Name_____ Period_____

	IV	V	VI	VII	VIII	IX
Numeration	1-4	5-8	9-13	14-18	19-23	24-28
Addition	1-4	5-8	9-11	12-14	15-17	18-20
Subtraction	1-4	5-8	9-11	12-14	15-17	18-20
Multiplication	1-6	7-12	13-15	16-18	19-20	21-22
Division	1-3	4-6	7-8	9-10	11-12	13-15
Fractions	1-3	4-7	8-11	12-15	16-19	20-23
Applications	1-3	4-6	7-9	10-12	13-15	16-18
Money	1-2	3-5	6-7	8-10		
Time	1-3	4-6	7-9	10-12	13-15	
Measurement	1-4	5-8	9-12	13-16	17-20	21-24
Geometry	1-3	4-6	7-9	10-12	13-15	16-18

Students who scored on the placement test in the ranges indicated in the correlation blocks will be placed in that level unit. Circle the scores for each strand.

APPENDIX C

SCOPE AND SEQUENCE CHART
FOR UNIT LEVELS VII, VIII, AND IX

	LEVEL VII Range of Numbers Taught 0-100,000 and thousandths	LEVEL VIII Range of Numbers Taught 0-100,000,000	LEVEL IX Range of Numbers Taught 0-1,000,000,000 and negative numbers
NUMERATION	Odds and Evens Decimals Order relation between numbers Divisibility rules Place value	Place value Order relation between numbers Number words	Place value Integers Number words
ADDITION	Addition of whole numbers Story problems	Addition of whole numbers Addition of decimals	Additive inverses Addition of integers
SUBTRACTION	Subtraction of whole numbers Story problems	Subtraction of decimals	Subtraction of integers
MULTIPLICATION	Uses distributive property to compute products (5 = digit x 1-digit or 2-digit x 2-digit) Standard multiplication algorithm Story problems	Standard multiplication algorithm Multiplication of decimals	Multiplication of decimals
DIVISION	Standard division algorithm (5-digit ÷ 1-digit or 4-digit ÷ 2-digit)	Rewrites fraction as division problem Standard division algorithm Story problems	Rewrites fraction as decimal Divides decimals, rounds answers
FRACTIONS	Lowest Common Multiple (LCM) Adds and subtracts fractions Adds and subtracts mixed numbers	Multiplicative inverse of fractions Percents Multiplication of fractions and mixed numbers	Writes fraction as decimal Division of fractions and mixed numbers Percent Order relation between fractions

SCOPE AND SEQUENCE CHART
FOR UNIT LEVELS VII, VIII, AND IX—Continued

	LEVEL VII	LEVEL VIII	LEVEL IX
APPLICATIONS	Order relation between "+, −" expressions Computes "averages" Commutative, associative, and distributive properties Story problems	Order relation between "+, −, x, ÷" expressions Story problems	Solves "+, −, x, ÷" problems involving a fraction and a decimal Percent problems Story problems
MONEY	Multiplication and division of money values (to $20) Story problems		
TIME	Clocks with second hands Adds and subtracts time with regrouping Story problems	24-hour clocks and 12-hour clocks Reads air, rail, and bus schedules Years, decades, centuries, and millennia	
MEASUREMENT	Ounces, pounds, and tons Performs (+, −, x, ÷) with various measures Bar graphs	Feet, yards, and miles Reads maps Time = distance/speed Graphs (bar, line, circle, picto-) Converts metric measures	Converts metric and English measures Story problems Temperature (F and C)
GEOMETRY	Identifies parallel, perpendicular, and intersecting lines Identifies congruent and similar figures Lines of symmetry	Constructs circle Classifies triangles Regular polygons Constructs parallel and perpendicular segments Size transformation	Locates points in a plane Area and perimeter Classifies quadrilateral Triangle sum property

THE GINN INDIVIDUALIZED MATHEMATICS SYSTEM KIT

Examples From Unit Level VII, Skill 2

1. Numeration
2. Addition
3. Subtraction
4. Multiplication
5. Division
6. Fractions
7. Applications
8. Money
9. Time
10. Measurement
11. Geometry

Numeration VII, Skill 2

Given a mixed decimal, 1.001 to 99,999.999, the student will be able to write or select the corresponding number word. Given a number word for the numbers 1.001 to 99,999.999, the student will be able to write or select the corresponding mixed decimal.

✱ Teaching page ◇ Practice page ✓ Extension page

Page	Contents and Procedures
✱ 1	Uses this chart of numbers and number words as reference for the remainder of the skill.
✱ 2, 3, 4	Uses Number-Number Word Machine as a reference model for the skill folder.
◇ 5	Selects appropriate digits to identify mixed decimals.
◇ 6	Writes mixed decimals for given number words.
◇ 7	Writes number words for given decimals.
8 ✓-up	Writes number words for given mixed decimals and vice versa.
✓ 9, 10	Renames mixed decimals.
✱ 11	Illustrates the writing of number words for decimals.
◇ 12	Completes a chart showing fractions, decimals, and corresponding number words.
✱ 13	Illustrates the writing of number words for mixed fractions and mixed decimals.
◇ 14	Writes number words for given mixed decimals.
◇ 15	Writes mixed decimals for given number words.
16 ✓-up	Writes number words for given mixed decimals and vice versa.

Here's a chart that will be of help to you in this folder. It shows how to spell some number words.

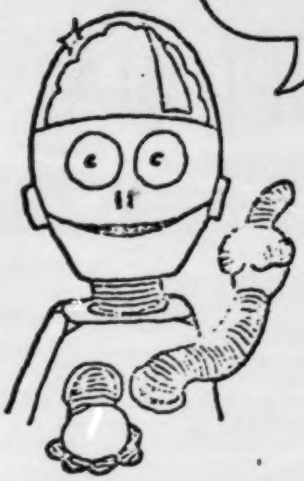
Number	Number Word
1	one
2	two
3	three
4	four
5	five
6	six
7	seven
8	eight
9	nine
10	ten
11	eleven
12	twelve
13	thirteen
14	fourteen
15	fifteen
16	sixteen
17	seventeen
18	eighteen
19	nineteen

Watch the spelling !

Number	Number Word
20	twenty
30	thirty
40	forty
50	fifty
60	sixty
70	seventy
80	eighty
90	ninety
100	one hundred
500	five hundred
900	nine hundred
1,000	one thousand
5,000	five thousand
9,000	nine thousand
10,000	ten thousand
50,000	fifty thousand
90,000	ninety thousand
99,000	ninety-nine thousand

Complete the chart.

	Fraction	Decimal	Number word
1.	$\frac{2}{100}$	0.02	two hundredths
2.		0.009	
3.			fifty-one hundredths
4.	$\frac{8}{10}$		
5.		0.40	
6.			six hundred seventy-five thousandths
7.	$\frac{23}{1000}$		
8.		0.1	
9.			two tenths
10.	$\frac{11}{100}$		
11.		0.412	
12.			nine hundredths
13.	$\frac{500}{1000}$		
14.		0.030	



Write the mixed decimals for these number words. The "and" shows where the decimal point belongs.

1. twenty-seven and eighteen hundredths

_____

2. five and two hundred fifty-six thousandths

_____

3. one thousand seven hundred eighty and two tenths

_____

4. nine hundred nine and ninety-nine thousandths

_____

5. forty-four and four hundred four thousandths

_____

6. one and one hundredth

_____

7. sixty-six thousand six and six hundred sixteen thousandths

_____

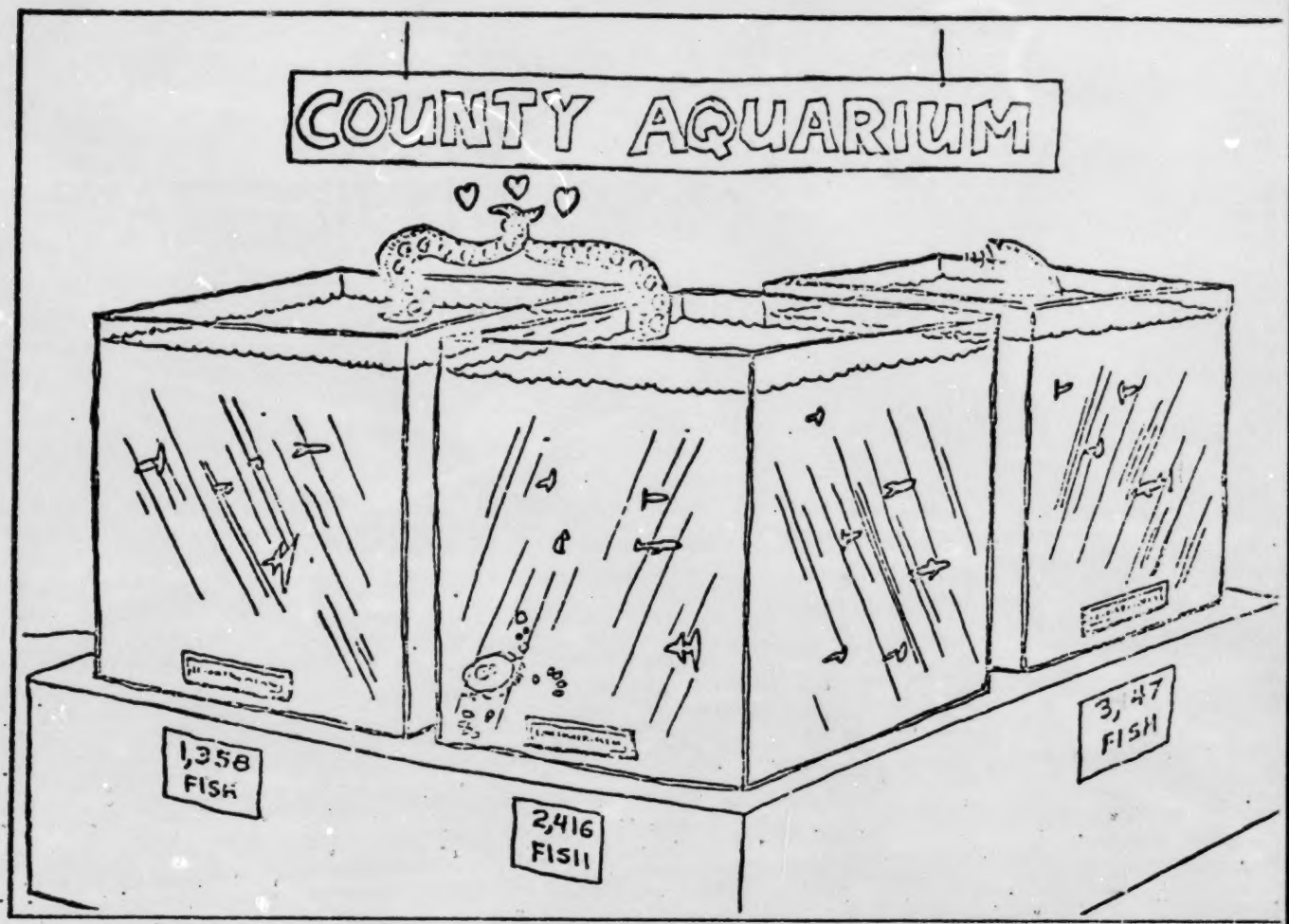
Addition VII, Skill 2

Given multiple-step word problems requiring addition skills, the student will be able to solve them (sums to 10,000).

* Teaching Page <> Practice Page 8 Extension Page

Page	Contents and Procedures
* 1, 2	Begins relating story problems to addition of whole numbers. Uses given data in more than one addition problem.
<> 3, 4, 5, 6	Uses data given in story problems to answer various questions involving addition.
<> 7	Adds numbers given in story problems - no decisions required.
<> 8	Decides how to use data given in story problems before adding.
9 ✓-up 10 ✓-up	Adds two to five numbers to answer story problems, some of which involve deciding which data to use for a given addition.
8 11	Performs column addition involving money to answer questions in word problems.
8 12	Uses addition to answer word problems that involve number relations including equalities, and inequalities.

Vocabulary: None.



1. How many fish are there in the three tanks pictured above?

$$1{,}358 + 2{,}416 + 3{,}147 = \square$$

2. Another tank in the aquarium has 1,576 fish.
How many fish in all four tanks?

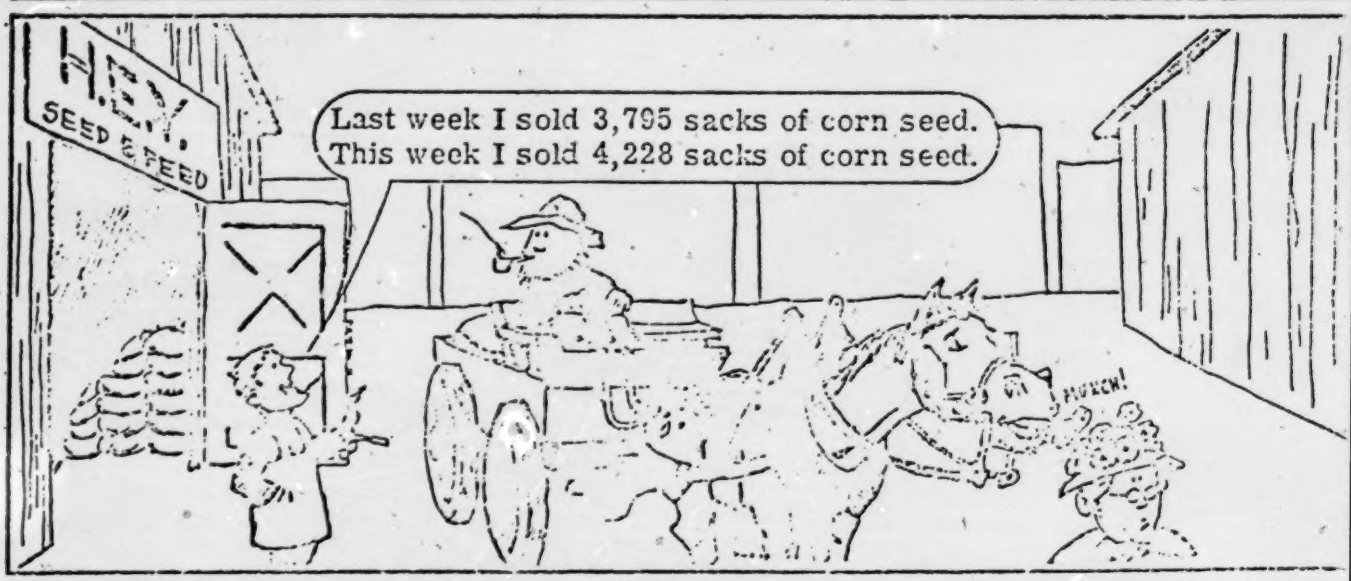
$$\square + 1{,}576 = \_\_\_\_\_$$

1. Al and Bob picked_____bushels in all.

2. Eunice picked as many bushels as Bob and Ella together picked. Eunice picked_____bushels of tomatoes.

3. Al, Ella, Bob, and Sid picked_____bushels in all.

4. _____picked more bushels of tomatoes than anyone else.



5. How many sacks of corn did H. E. Y. sell during these two weeks?_____

6. The seed store across the street sold 100 sacks more than H. E. Y. sold last week. How many sacks did they sell last week? _____

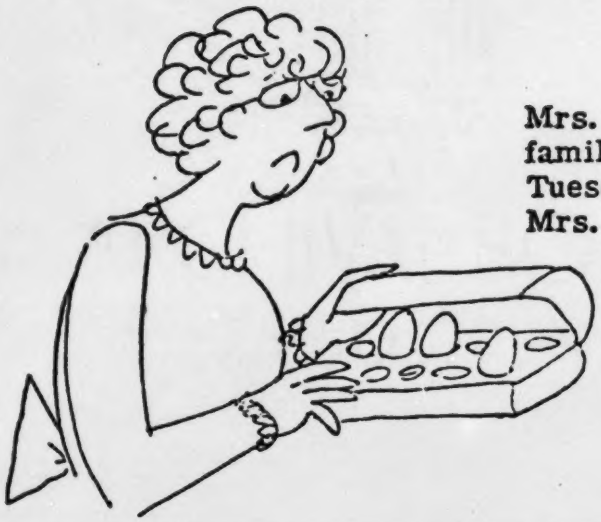
Subtraction VII, Skill 2

Given multiple-step word problems, the student will be able to solve them using the subtraction skills mastered.

* Teaching Page <> Practice Page 8 Extension Page

Page	Contents and Procedures
* 1	Illustrates a method of solving two-step word problems involving subtraction.
* 2	Uses the method illustrated on page one to solve a multi-step word problem.
<> 3, 4, 5 6, 7, 8	Solves multi-step word problems involving subtraction.
9 ✓-up 10 ✓-up	Solves multi-step word problems involving subtraction.

Vocabulary: None.



Mrs. Walton bought 2 dozen eggs (24) to last her family for three days. Monday she cooked 6 eggs Tuesday she used 10 eggs. How many eggs does **Mrs.** Walton have left for Wednesday's meals?

How would you solve this problem?

First, I'd collect the facts I know!

24 eggs for three days
6 eggs cooked Monday
10 eggs used Tuesday

Then, I'd ask what I need to know!

How many eggs left for Wednesday's meal?

Then, I'd decide how to find my answer!

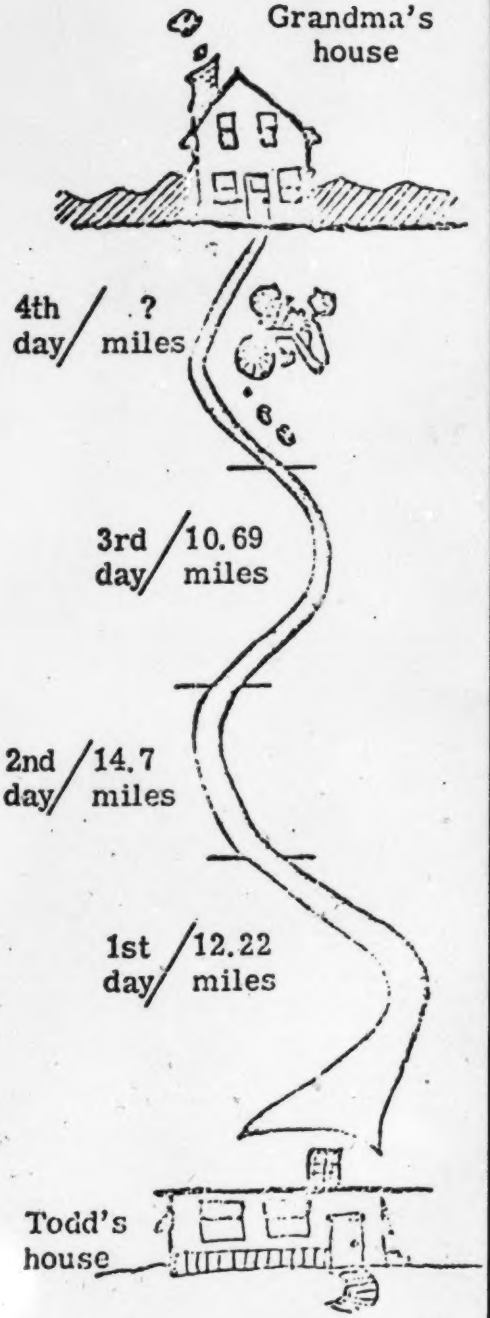
6 eggs cooked Monday
+ 10 eggs used Tuesday
16 eggs used in two days

→

24 eggs for three days
- 16 eggs used in two days
eggs left for Wednesday

1. Mrs. Walton has_____eggs left for Wednesday's meals.

1.
Todd took a four day bicycle trip to his Grandma's house. On the first day he traveled 12.22 miles. On the second day he traveled 14.7 miles. On the third day, he went 10.69 miles. If his Grandma lives 50 miles from Todd's house, how many miles did he have left to travel on the fourth day to complete his trip?



Solution:

What do we know?
50 miles to Grandma's house

12.22 miles traveled 1st day
14.7 miles traveled 2nd day
10.69 miles traveled 3rd day

What do we need to know?

How many miles left to travel on 4th day.

How do we find the answer?

12.22 miles
14.7 miles
10.69 miles
miles traveled in 3 days

50.00 to travel
- miles traveled in 3 days
miles left to travel on 4th day

Multiplication VII, Skill 2

Given multiples of 10 (less than 100) and/or multiples of 100 (up to 1,000) the student will be able to determine the product of any whole number and one of these multiples (products to 100,000).

* Teaching Page ◇ Practice Page 8 Extension Page

Page	Contents and Procedures
* 1	Illustrates the use of the distributive principle to multiply 4-digit numbers by 10.
◇ 2, 3	Uses procedures illustrated on page 1 to multiply 4-digit numbers by 10.
* 4	Introduces algorithm for multiplying a whole number by 10.
◇ 5	Uses algorithm introduced on page 4.
* 6	Introduces algorithm for multiplying 4-digit whole numbers by multiples of 10 less than 100.
◇ 7	Uses algorithm introduced on page 6.
◇ 8	Multiplies 3- and 4-digit whole numbers by multiples of 10 less than 100.
* 9	Introduces algorithm for multiplying 3-digit whole numbers by 100.
◇ 10	Uses algorithm introduced on page 9.
* 11	Introduces algorithm for multiplying 3-digit whole numbers by multiples of 100 less than 1000.
◇ 12	Uses algorithm introduced on page 11.
* 13	Introduces algorithm for computing products whose factors are whole number multiples of 10 or 100 less than 1000.

THE CASE OF The Extraordinary Multiplier
Hey, Sam! C'mon down right away. We've got a . . .
. . . real problem on our hands.
Be right down, Simon.
MR. SIMONE
What's up?
We've got 10 bleefs in the bin, 6 on the left and 4 on the right. We've never used a x 10 multiplier sticker before.
BLEEFS
INVENTORY SHEET
SIMONE'S MULTO-GUIDE
10,000 1000 100 10 1
TRADES
1 BLEEF
1 3 1 0
x 10
TOTAL
That's true, but you've just given me an idea. Come to my office and I'll explain.
This is what the total would be if you had just 6 bleefs. . .
. . . and this is what the total would be if you had just 4 bleefs.
So you added the two totals to get. . .
. . . this total which is what we should get for 10 bleefs. I see!

1.

(a)

INVENTORY SHEET — SIMONE'S MULTO-GUIDE						
	10,000	1000	100	10	1
TRADES		1			
1 BLEEF		1	3	1	0
			x	6	
TOTAL					

+

(b)

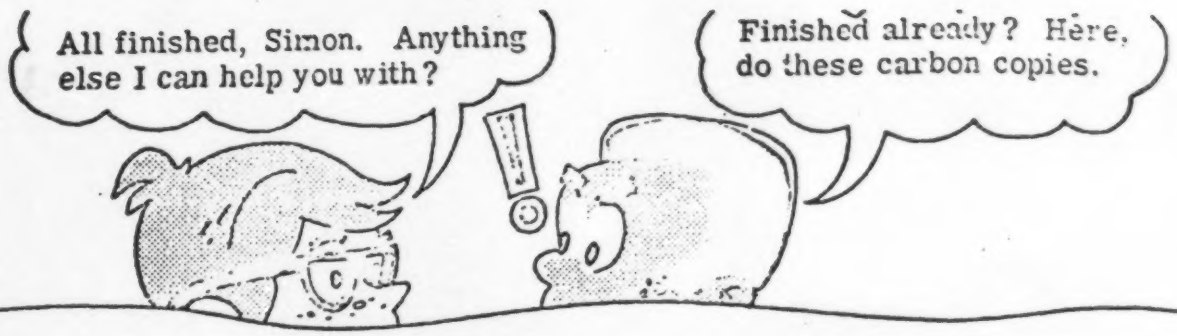
INVENTORY SHEET — SIMONE'S MULTO-GUIDE						
	10,000	1000	100	10	1
TRADES		1			
1 BLEEF		1	3	1	0
			x	4	
TOTAL					

(c)

7860
+ 5230

(d)

INVENTORY SHEET — SIMONE'S MULTO-GUIDE						
1 BLEEF		1	3	1	0
			x	10	
TOTAL						



1. CARBON COPY
$$\begin{array}{r} 200 \\ \times\ 30 \\ \hline \end{array}$$

2. CARBON COPY
$$\begin{array}{r} 20 \\ \times 300 \\ \hline \end{array}$$

3. CARBON COPY
$$\begin{array}{r} 700 \\ \times\ 10 \\ \hline \end{array}$$

4. CARBON COPY
$$\begin{array}{r} 70 \\ \times 100 \\ \hline \end{array}$$

5. CARBON COPY
$$\begin{array}{r} 40 \\ \times 30 \\ \hline \end{array}$$

6. CARBON COPY
$$\begin{array}{r} 50 \\ \times 50 \\ \hline \end{array}$$

7. CARBON COPY
$$\begin{array}{r} 10 \\ \times 80 \\ \hline \end{array}$$

8. CARBON COPY
$$\begin{array}{r} 90 \\ \times 20 \\ \hline \end{array}$$

9. CARBON COPY
$$\begin{array}{r} 200 \\ \times 400 \\ \hline \end{array}$$

10. CARBON COPY
$$\begin{array}{r} 300 \\ \times 200 \\ \hline \end{array}$$

11. CARBON COPY
$$\begin{array}{r} 500 \\ \times 100 \\ \hline \end{array}$$

12. CARBON COPY
$$\begin{array}{r} 300 \\ \times 300 \\ \hline \end{array}$$

Division VII, Skill 2

The student will be able to use the division algorithm to divide a four or five-digit whole number by a one-digit whole number.

✱ Teaching Page ◇ Practice Page ♂ Extension Page

Page	Contents and Procedures
✱ 1	Establishes notion that division of output by input will give the rate.
◇ 2	Extracts information from a chart and uses it to arrive at answers to division problems.
♂ 3	Fits information together and does computation in order to complete a chart record.
4 ✓-up	Performs division problems with single-digit divisors, four-digit dividends and no remainders. (A preliminary check-up only).
✱ 5 ◇ 6 7 ✓-up	Zero as a placeholder in division problems is stressed. Problems are written out in such a way that entering a zero in the quotient becomes natural. (A preliminary check-up only).
✱ 8 ◇ 9	Need for checking division by multiplying is pointed out, and student practices using this procedure.
✱ 10 11 ✓-up	Remainders are introduced as extra items to be produced that do not fit exactly the output ÷ input = rate model. (A preliminary check-up only).
✱ 12	Five-digit dividends are introduced via an extension of the model used earlier.

TOOTHPICK CARVING DEPARTMENT
ATTENDANCE RECORD - WEEK OF April 10

✓ - Here A - Not Here	Ted	Bill	Sue	Mike	Lisa	Pete
Monday	✓	✓	✓	✓	✓	✓
Tuesday	✓	A	✓	✓	✓	✓
Wednesday	✓	✓	✓	✓	✓	✓
Thursday	✓	✓	A	✓	✓	A
Friday	✓	✓	✓	✓	A	✓

Everyone was here.

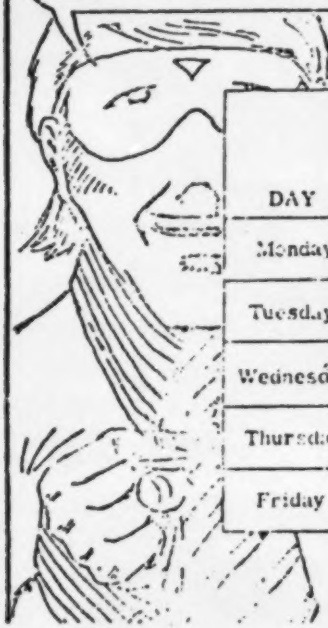
Bill was absent.

Tell how many carvers were at work each day during the week of April 10.

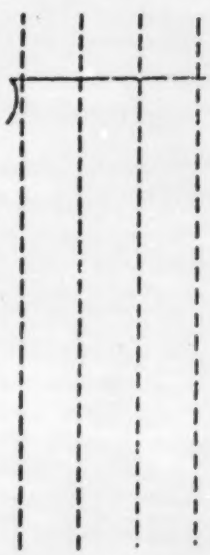
1. Monday _____
2. Tuesday _____
3. Wednesday _____
4. Thursday _____
5. Friday _____

Complete the chart to tell how many toothpicks each carver had to carve each day.

TOTAL TOOTHPICKS ÷ NUMBER OF CARVERS = TOOTHPICKS / CARVER
OUTPUT INPUT RATE



DAY	WEEK OF APRIL 10 NUMBER OF CARVERS	TOOTHPICKS / CARVER	TOTAL TOOTHPICKS
Monday		6.	1248
Tuesday		7.	1300
Wednesday		8.	1296
Thursday		9.	1260
Friday		10.	1320



Complete this chart. The division problems at the bottom of the page are clues to help you.

DAY	WEEK OF APRIL 17 NUMBER OF CARVERS	TOOTHPICKS / CARVER	TOTAL TOOTHPICKS
Monday	8	1.	2.
Tuesday	3.	241	4.
Wednesday	5.	6.	1028
Thursday	7.	260	8.
Friday	5	9.	10.

$5\overline{)1310}$

$7\overline{)1820}$

$6\overline{)1446}$

$4\overline{)1028}$

$8\overline{)2256}$

Fractions VII, Skill 2

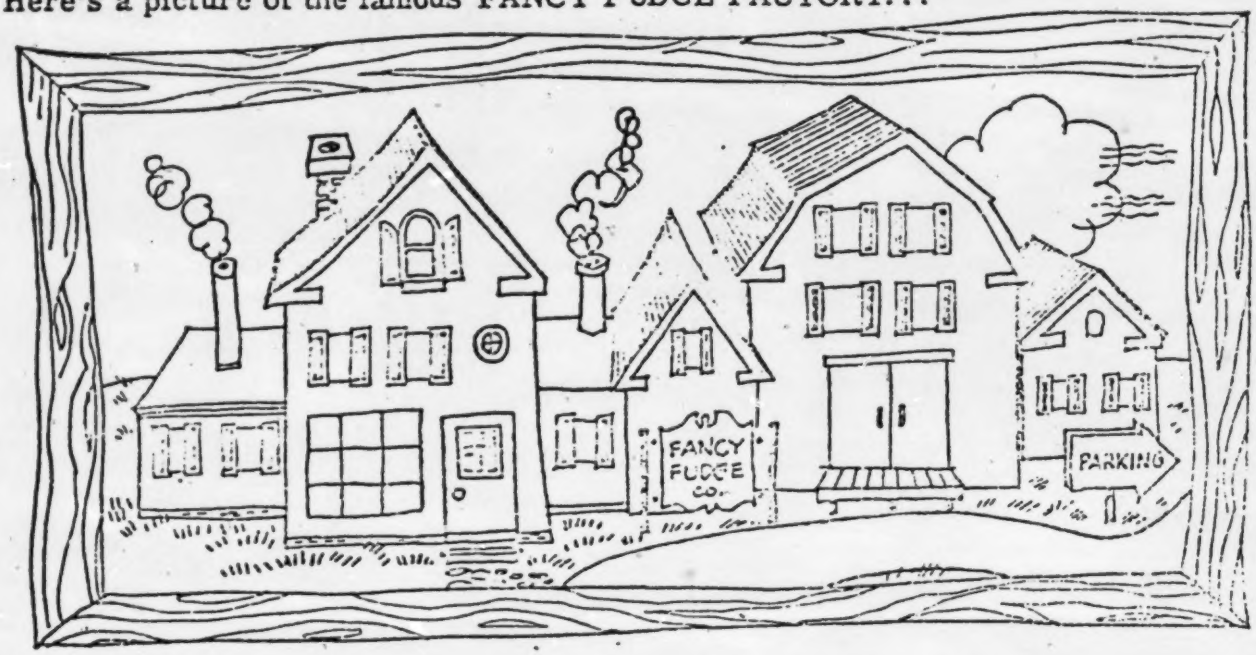
Given two mixed numbers, in vertical or horizontal form, the student will be able to add them and express the sum as a mixed number, or a whole number, accordingly.

⁂ Teaching Page ◇ Practice Page ⁂ Extension Page

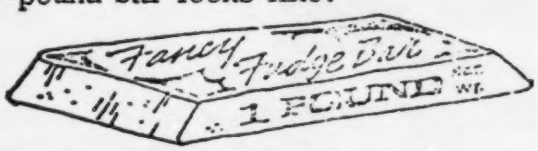
Page	Contents and Procedures
⁂ 1	Introduces fudge factory story.
◇ 2, 3	Renames mixed numbers as fractions.
⁂ 4	Introduces motivation for using mixed numbers.
◇ 5	Renames fractions ($\frac{n}{d}$; $n>d$) as mixed numbers.
⁂ 6	Sets up the rule for the fraction of a mixed number to be a fraction less than one and in simplest form.
◇ 7, 8, 9	Adds mixed numbers with fractions having the same denominator (vertical and horizontal forms).
⁂ 10	Teaches addition of mixed numbers with fractions having different denominators.
◇ 11	Adds mixed numbers with fractions having different denominators (vertical and horizontal forms).
◇ 12	Adds mixed numbers (horizontal and vertical forms).
13✓-up 14✓-up	Adds mixed numbers (vertical and horizontal forms).

Vocabulary: None.

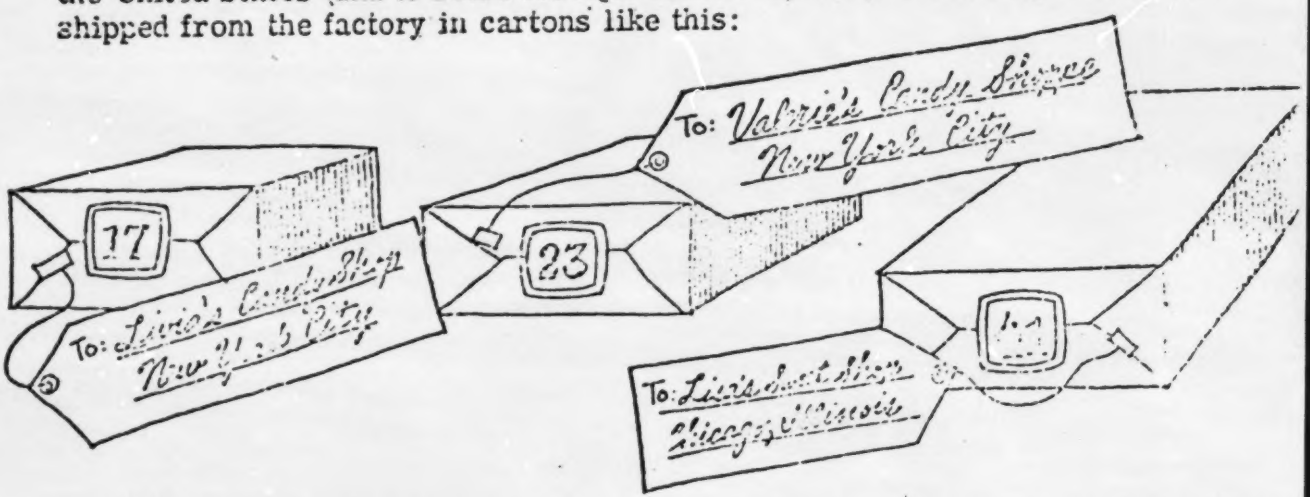
Here's a picture of the famous FANCY FUDGE FACTORY...



The Fancy Fudge Factory makes delicious 1-pound fudge bars. Here's what their 1-pound bar looks like.



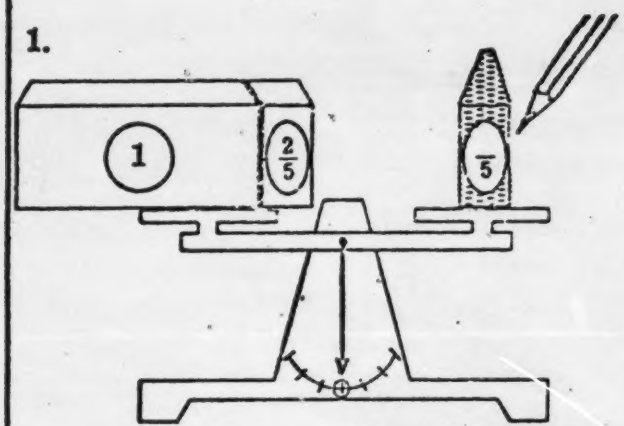
The Fancy Fudge Factory ships its fancy fudge bars to candy stores all over the United States (and to some foreign countries, too). The fudge bars are shipped from the factory in cartons like this:



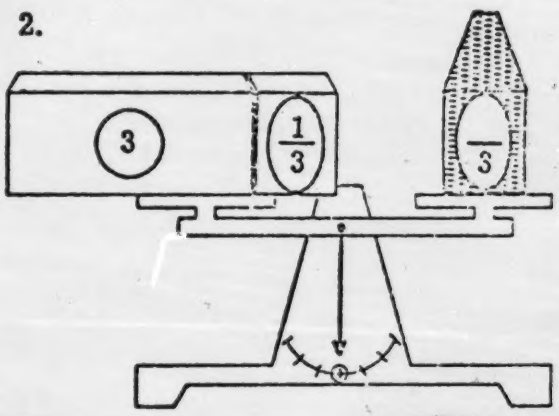
The label on the front of the carton shows how many fudge bars are in the carton. For example, the picture shows a carton of 17 bars ready to be shipped to LIVIA'S CANDY SHOP in New York City.

In each problem the two shipments on the scale weigh the same. You finish the labeling job.

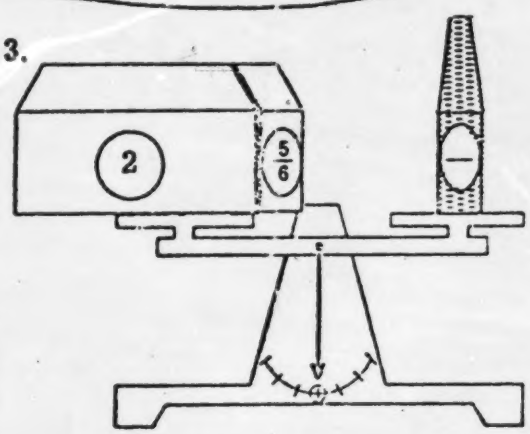
1.



2.



3.



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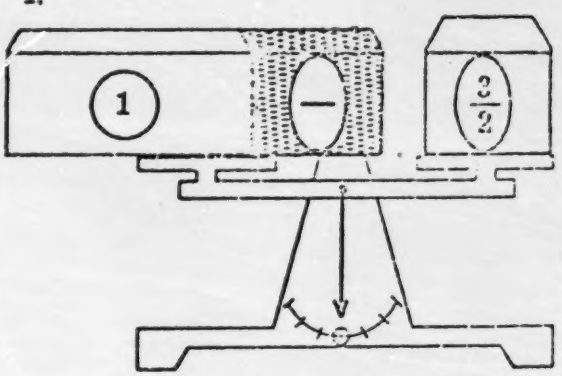

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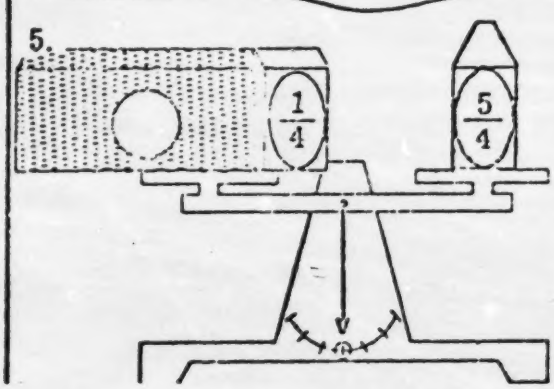
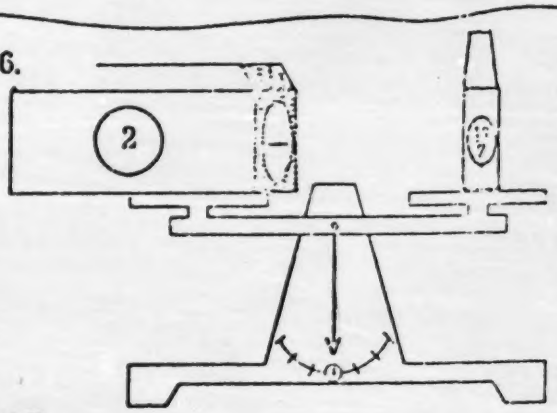


6.



Fancy Fudge Factory NEW SHIPPING CLERK'S TEST

Department of Personnel and Instruction

1. $3\frac{1}{4} + 2\frac{3}{4} =$ ____

2. $3\frac{1}{2} + 2\frac{7}{8} =$ ____

3. $4\frac{3}{7}$
$+ 5\frac{4}{7}$

4. $4\frac{4}{7}$
$+ 4\frac{6}{7}$

5. $2\frac{1}{3}$
$+ 3\frac{1}{6}$

6. $3\frac{13}{100} + 7\frac{97}{100} =$ ____

7. $3\frac{1}{3}$
$2\frac{5}{6}$
$+ 3\frac{1}{9}$

8. $4\frac{2}{9}$
$+ 3\frac{7}{9}$

9. $4\frac{1}{2} + 2\frac{9}{10} + 3\frac{4}{5} =$ ____

10. $3\frac{3}{7} +$ ○ $= 5\frac{1}{7}$ What goes here?

Applications VII, Skill 2

Given a set of whole numbers, the student will be able to compute the arithmetic mean.

* Teaching Page ◇ Practice Page 8 Extension Page

Page	Contents and Procedures
* 1, 2	Examines three different averages (mean, median and mode) and selects the Arithmetic Mean to work with.
◇ 3, 4 5, 6	Computes Arithmetic Mean of a set of grades, also identifies median (middle grade) and mode (typical grade).
◇ 7	Computes Arithmetic Mean of a set of basketball game scores.
◇ 8	Computes Arithmetic Mean of basketball team members' fouls accumulated during a game and average points per man.
◇ 9	Computes Arithmetic Mean of heights of basketball players.
* 10	Computes the total number of runs scored by a baseball team given the mean number of runs scored per game and the total number of games played.
◇ 11, 12	Computes mean for various data; i. e., annual rainfall, racing car speeds, skill folder pages, prices of fish, and telephone calls.
13√-up 14√-up	Computes the average (Arithmetic Mean) of sets of whole numbers (sums to 1000 and whole number means).

Vocabulary: Arithmetic Mean, vital statistics.

...Sorry, Wilt, there's no way that you can play tonight. If I could just use your middle grade... ____, things would be different, but I can't. Your typical score is___and...I wouldn't want to use that.

Yeah, I know . . . They said you must use the Arithmetic Mean which for me is a _____ and it's not a passing grade. Sorry, Coach, I guess I'll never make it.

WILT SEE

1. 75
2. 71
3. 70
4. 67
5. 66
6. 65
7. 64
8. 63
9. 63
10. 63
11. 40

704

MIDDLE SCORE

ARITHMETIC MEAN

11)704

TYPICAL SCORE

Sorry Willis, you can't play tonight, either. Your middle score -____ is good enough, and your typical score -____ is passing too, but I can't use either one. If only you'd gotten a 20 for your last mark instead of 9...

Yea, I know... You must use the _____ ____ which for me is a____... like Wilt. Oh, well, good luck in tonight's game, Coach. I sure hope Lew doesn't get in any foul trouble !!

WILLIS ARR

1. 75
2. 74
3. 73
4. 72
5. 71
6. 70
7. 65
8. 65
9. 65
10. 65
11. 9

MIDDLE SCORE

ARITHMETIC MEAN

11)704

TYPICAL SCORE

...and over at Jerry's house... 1.

What's that you're figuring out, Laura?

My teacher gave me this chart and asked me to figure out the average number of pages in the Level VI Multiplication Skill Folders.

Skill Folders	1	2	3	4	5	6	7	8
Pages Per Folder	14	16	14	16	18	24	14	20

I figure there's an average of_____ pages per skill folder.

...at Oscar's girl's house... 2.

Guess what, O !! Spoke D. Wheel, the sports car racer, drove three trial laps at 138 MPH, 145 MPH, and 131 MPH.

That means his average speed per lap was_____MPH. Now, can we go over to Bob's place?

...meanwhile, at Bob's place... 3.

Hey, Bob, it says here that old Captain Clambake's 3 fishing boats brought back fish that sold for $2870, $3020, and $410

Yeah, well that means the three boats together averaged $_____. Now, can we go over to Oscar's house?

...and, over at Lou Aech's place... 4.

Lou, you quit eating all those oranges. I just paid $2.16 for two dozen of them.

Wow, Mom,.. I didn't know oranges cost that much. Why, that's an average of _____cents an orange.

...and, finally, at Sidney's place... 5.

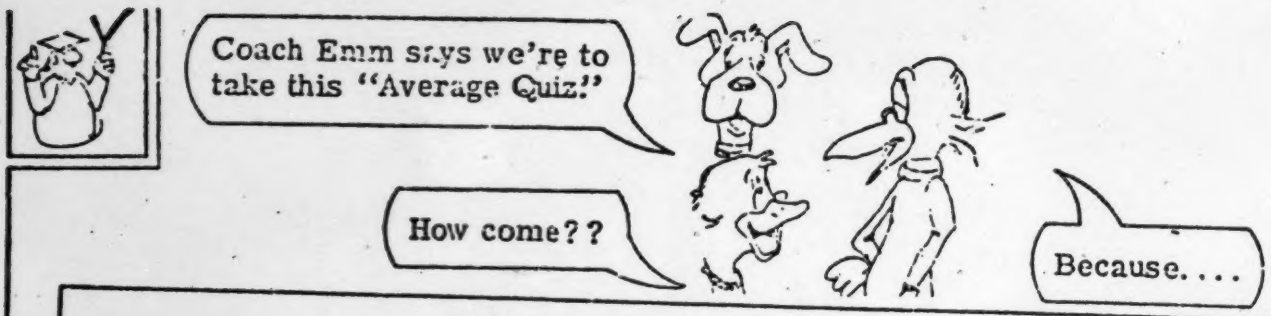
Hey Austin, how many times did you call Althea last week?

Let's see...

He averaged_____ calls a day.

S	M	T	W	T	F	S
15	12	17	9	[illegible]	13	[illegible]

Sidney averaged 3 more calls per day speaking to me. So, he made a total of _____ calls last week.



Coach Emm's Average Quiz
FORM A

1. In his last 8 games Jon scored 22, 15, 12, 19, 23, 12, 17, 24 points. He averaged

144	8	18	NONE OF THESE
A	B	C	D

2. The Northside Cavaliers averaged 70 points a game during their 20-game season. That means they scored a total of_____points during the season.

Here are two sacks of numbers:

3. From sack A, the two numbers which have as their average the number in sack B are_____,_____.

4. From sack A, the four numbers which have as their average the number in sack B are_____, _____, _____, _____.

5. From sack A, the six numbers which have as their average the number in sack B are_____, _____, _____, _____, _____, _____.

6. Loop the 'T' if the following statement is true, otherwise loop the 'F'.

It is impossible to find three numbers from sack A whose average is the number in sack B. T F

Money VII, Skill 2

Given a one- or two-step word problem involving addition, subtraction, multiplication, or division of money values, the student will be able to solve it (values to $20.00).

* Teaching Page ◇ Practice Page δ Extension Page

Page	Contents and Procedures
◇ 1, 2, 3, 4, 5, 6	Solves one- or two-step word problems involving addition, subtraction, multiplication, and division of money values.
7✓-up 8✓-up	Solves one- or two-step word problems involving money values.

Vocabulary: None.

Wizard, you must help Duane win! Please!
OK, but I'll have to do some magic... hmmm...
MAGIC CATALOG
Wands ..... 9 for $10.35
Wasps ..... doz for $ 0.10
Watermelons ..... 2 for $ 1.95
Weather Bureau ..... 1 for $15.00
Whirlwinds ..... 3 for $10.00

1.
Cost of one wand $____
one watermelon $____
one whirlwind $____

Total: $____

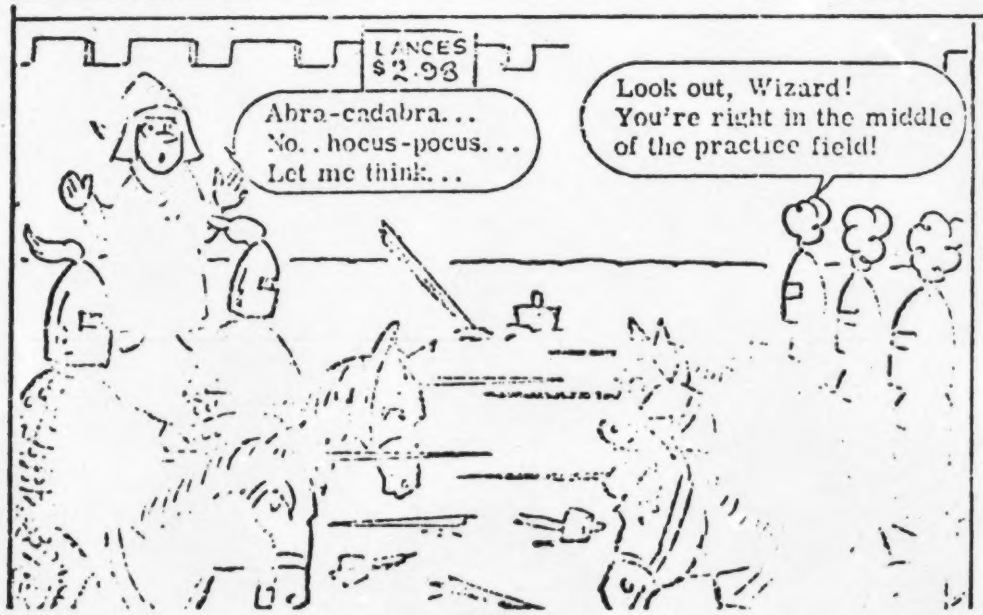
Here's $20, Squire. Go buy the magic supplies. Be back by tournament time tomorrow.
TOLL $0.35
HOTEL MEALS 1.45 ROOM 2.50
Ok, but I'll have to pay for my traveling expenses from the $20.

2.
Cost of two meals $____
one room $____
two bales of hay $____
tolls (going and coming) $____

Total: $____

3.
Will $20 cover the expenses and the supplies?

Yes No



4.
The Squire spent $14.52 altogether. How much change should he have?

$____

5.
Count the broken lances in the picture. How much will it cost to replace them?

$____

Answers

3. Yes
2. $7.90 5. $8.94
1. $20.10 4.

1. Cost of 2 loaves at 4 loaves for $0.50:

   $_____

2. Cost of 6 loaves:

   $_____

3. Cost of a set of horseshoes for one horse:

   $_____

4. How much change should the man get from $2.00?

   $_____

Let's count our money. Here's $1.00 from the bread.
Here's $4.56 from the lances.
I got $10.80 from the bottles.
One horse bought shoes. Here's $1.36.

5. Total amount from sales:

   $_____

6. Each man's share (don't forget the $2.50 from the king):

   $_____

7. Who made more, the clean-up men or the losing knights? _____
   (See page 3)

8. How much more?_____

Time VII, Skill 2

Given one-step word problems which do not require the regrouping of minutes into hours or seconds into minutes, the student will be able to solve them by adding or subtracting time units (maximum time difference of 2 1/2 hours).

* Teaching Page ◇ Practice Page 8 Extension Page

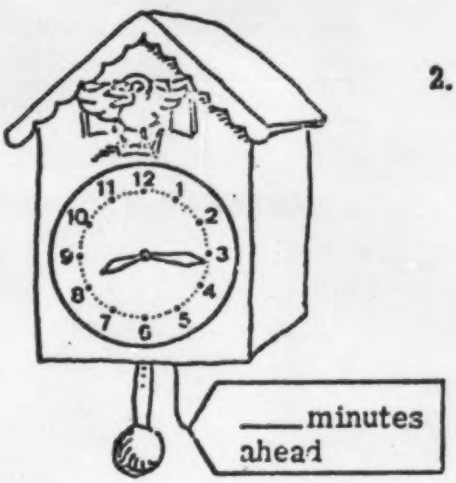
Page	Contents and Procedures
* 1	"Checks" clocks to see if they are too fast or too slow.
* ◇ 2, 3	"Adjusts" clocks that are running too fast or too slow.
◇ 4, 5	Solves a variety of one-step word problems to get to the dentist, pizza parlor, and return home.
8 6	Solves several puzzles and riddles.
◇ 7	Solves several "one-liners" (one-step word problems).
8✓-up	Adds or subtracts time units to do one-step word problems which do not require the regrouping of minutes into hours, or seconds into minutes (maximum time difference of $2\frac{1}{2}$ hours).

Vocabulary: None

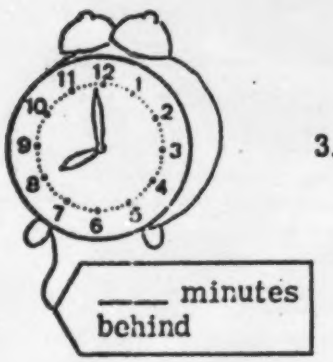
MARCH 26
MON
CLOCK SHOP
Monday morning All the clocks in the store must be wound and set.
...At the tone, the time will be 8:14... Bzzzz...
This clock says 8:09. That's 5 minutes behind. I've made a note of that.
5 min behind

Check each clock on the page and make a note of how far off it is from 8:14.

1.

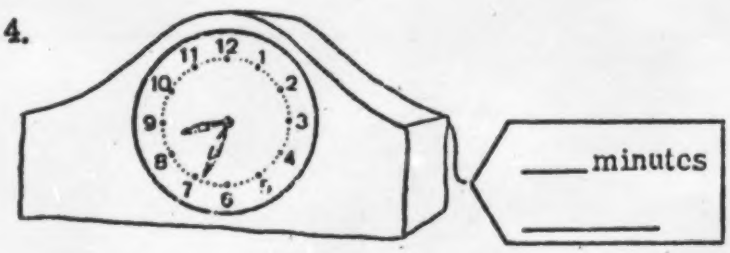


2.

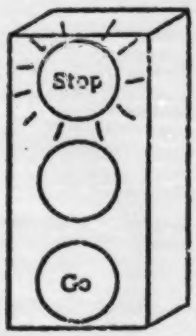


3.

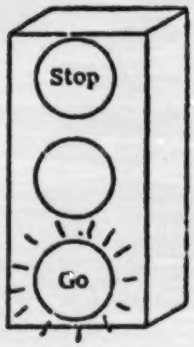
4.



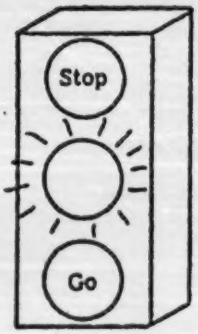
5. Cross out the clock that is one hour behind.



27 seconds

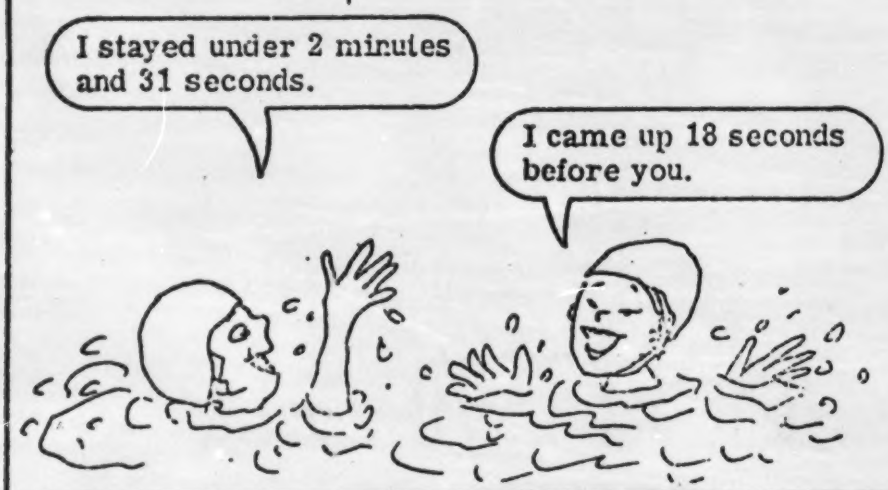


22 seconds



5 seconds

1. How long is one cycle of the traffic signal? _____



2. How long did the second boy stay under? _____

The conversation began at 6:15:45 PM

45 seconds after 6:15

The conversation ended at 6:27:56 PM

3. How long was the conversation? _____

4. How much longer could he have talked for $2.25? _____

Measurement VII, Skill 2

Given a fluid ounce as a unit of volume measurement, the student will be able to use the relationships 8 fl. oz = 1 cup and 16 fl. oz. = 1 pint to solve conversion problems. Given an ounce as a unit of measurement, the student will be able to identify instances where the ounce is a unit of weight and instances where the ounce is a unit of volume.

⁂ Teaching Page ◇ Practice Page ⁕ Extension Page

Page	Contents and Procedures
⁂ 1	Introduces "fluid ounce" as a measure of volume and "ounce" as a measure of weight. Given conversions of fluid ounces to cups to pints. Indicates that "fluid ounce" is abbreviated "fl. oz."
◇ 2	Indicates whether given objects would be measured by weight or by volume.
⁂ 3	Compares the conversion of fluid ounces to cups and pints with the conversion of ounces to pounds. Completes problems involving these conversions.
◇ 4	Converts fluid ounces to cups and pints and converts ounces to pounds.
5✓-up 6✓-up	Makes conversions of fluid ounces to cups or pints and of ounces to pounds.

Vocabulary: fluid ounces, fl. oz., weight

A fluid ounce measures volume

An ounce measures weight

1. 8 fl. oz. = 1 cup

2. 8 oz. = $\frac{1}{2}$ pound

3. 16 fl. oz. = 1 pint

4. 16 oz. = 1 pound

5. 18 fl. oz. =

16 fl. oz. + 2 fl. oz. =

1 pint + $\frac{2}{16}$ pint =

$1\frac{2}{16}$ pints

6. 18 oz. =

16 oz. + 2 oz. =

1 pound + $\frac{2}{16}$ pound =

$1\frac{2}{16}$ pounds

7. 9 fl. oz. =

8 fl. oz. + 1 fl. oz. =

____ cup + ____ cup =

____ cups

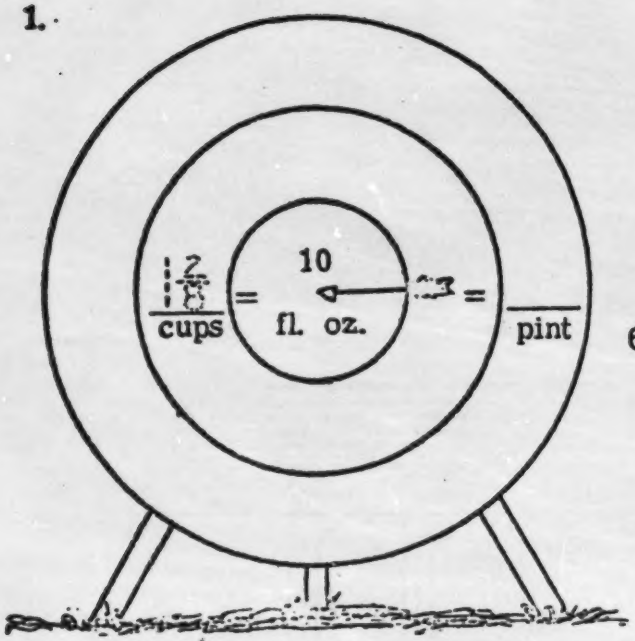
8. 9 oz. =

8 oz. + 1 oz. =

____ pound + ____ pound =

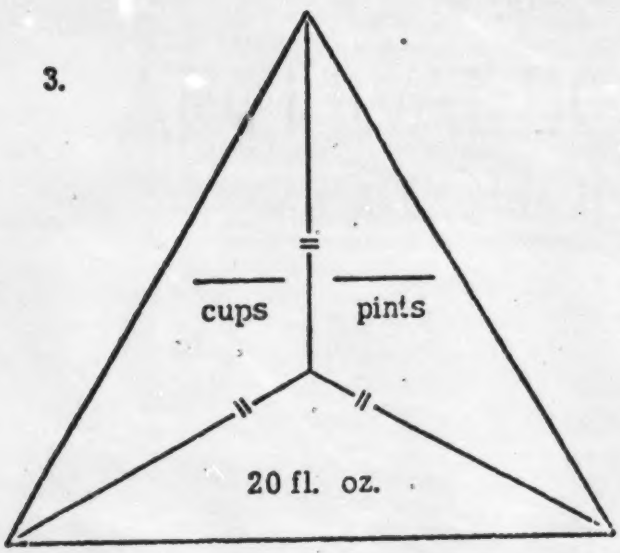
____ pound

1.



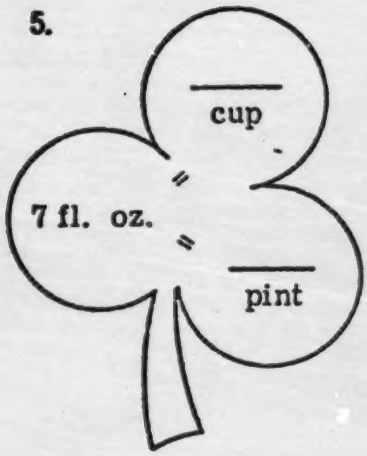
2. 10 ounces = _____ pound

3.



4. 20 ounces = _____ pounds

5.



6. 7 oz. = _____ pound

7.

8. 12 oz. = _____ pound

Geometry VII, Skill 2

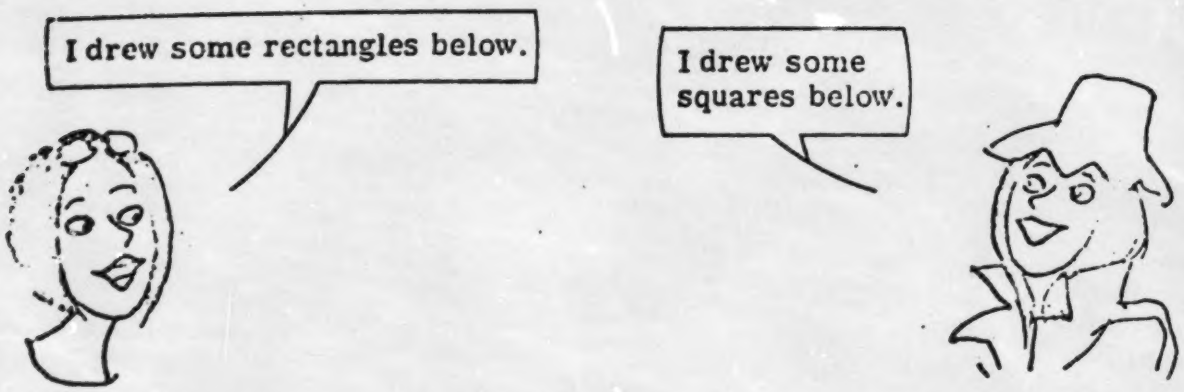
Given a quadrilateral, the student will be able to classify it by the length of its sides or sizes of its angles, and state at least one of its other properties.

* Teaching Page <> Practice Page E Extension Page

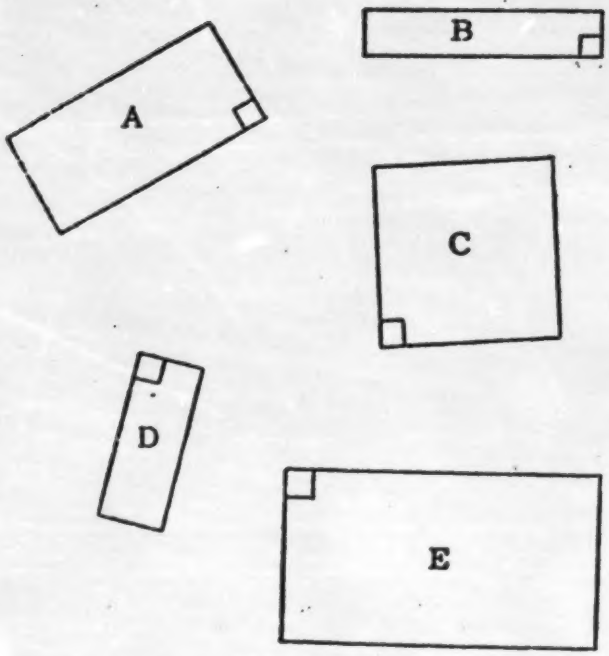
Page	Contents and Procedures
* 1, 2	Describes square and rectangle. Identifies given figures as squares and/or rectangles.
* 3	Describes rhombus. Identifies given figures as rhombuses.
* 4, 5	Describes parallelogram. Classifies other figures as parallelograms.
6✓-up	Classifies given quadrilaterals by all appropriate names.
* 7	Describes trapezoid. Identifies given figures as trapezoids.
* 8	Describes isosceles trapezoid. Identifies given figures as isosceles trapezoids.
<> 9	Names quadrilaterals, given a property.
10✓-up	Classifies given quadrilaterals by name.

Vocabulary: rhombus, parallelogram, trapezoid, isosceles trapezoid

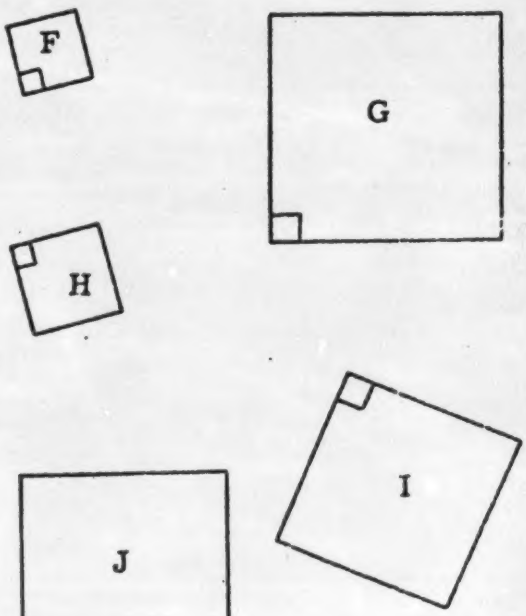
Materials: protractor, centimeter ruler



RECTANGLES



SQUARES



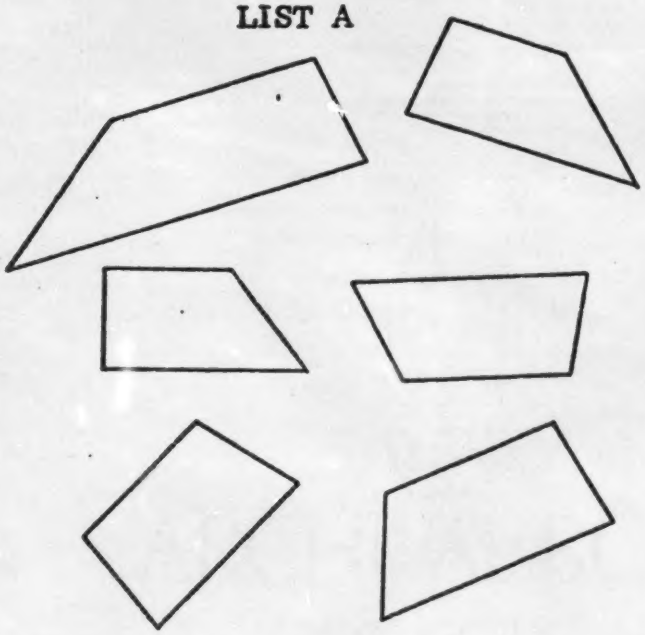
1. Mark each right angle with a corner mark as shown.

2. Are there any congruent figures above?_____ If so, how are they labeled?_____

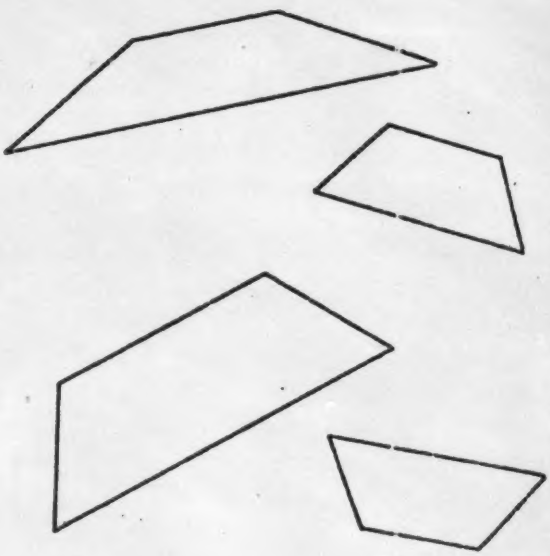
There is one big difference between the trapezoids in these two lists.

See if you can find the difference.

LIST A



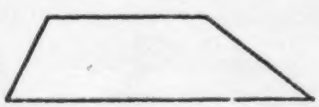
LIST B

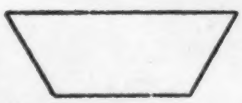


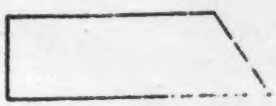
In list B the opposite sides that are not parallel to each other are congruent. These trapezoids are ISOSCELES TRAPEZOIDS.

Opposite sides are ones that do not form an angle.

X the isosceles trapezoid below.

1. 

2. 

3. 

APPENDIX D

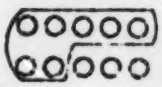
THE HOLT INDIVIDUALIZED COMPUTATION SERIES

Examples From Set 2, Unit 5

Addition and Subtraction, Fractions

STUDY

$\frac{3}{8}$ is shaded.



$\frac{7}{10}$ is circled.

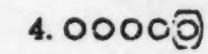
DO

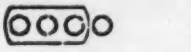
What fractional part is shaded or circled?

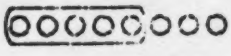
1. .....

2. .....

3. .....

4.  .....

5.  .....

6.  .....

STUDY

$\frac{2}{3}$ ← 2 is the numerator.
3 ← 3 is the denominator.

DO

Name the numerator.

7. $\frac{1}{2}$ ..... $\frac{3}{4}$ ..... $\frac{7}{8}$ ..... $\frac{99}{100}$ .....

Name the denominator.

8. $\frac{1}{2}$ ..... $\frac{3}{4}$ ..... $\frac{7}{8}$ ..... $\frac{99}{100}$ .....

ADDING FRACTIONS WITH THE SAME DENOMINATORS

STUDY

$\frac{1}{4}+\frac{2}{4}=\frac{1+2}{4}$, or $\frac{3}{4}$

$\frac{3}{8}+\frac{2}{8}=\frac{3+2}{8}$, or $\frac{5}{8}$

To add two fractional numbers with the same denominator, add the two numerators and keep the denominator.

DO

Fill in blanks.

1. $\frac{1}{8}+\frac{2}{8}=\frac{1+2}{\quad}$, or $\frac{3}{\quad}$

2. $\frac{2}{10}+\frac{5}{10}=\frac{2+5}{\quad}$, or $\frac{7}{\quad}$

3. $\frac{1}{4}+\frac{2}{4}=\frac{1+\quad}{4}$, or $\frac{\quad}{4}$

4. $\frac{3}{9}+\frac{4}{9}=\frac{3+\quad}{9}$, or $\frac{\quad}{9}$

5. $\frac{3}{10}+\frac{4}{10}=\frac{\quad+4}{10}$, or $\frac{\quad}{10}$

6. $\frac{3}{7}+\frac{2}{7}=\frac{\quad+2}{7}$, or $\frac{\quad}{7}$

Add.

7. $\frac{1}{8}+\frac{4}{8}=$ ____

$\frac{2}{5}+\frac{2}{5}=$ ____

$\frac{1}{6}+\frac{4}{6}=$ ____

8. $\frac{3}{10}+\frac{6}{10}=$ ____

$\frac{3}{12}+\frac{8}{12}=$ ____

$\frac{1}{3}+\frac{1}{3}=$ ____

9. $\frac{5}{7}+\frac{1}{7}=$ ____

$\frac{9}{24}+\frac{8}{24}=$ ____

$\frac{4}{9}+\frac{4}{9}=$ ____

SUBTRACTING FRACTIONS WITH THE SAME DENOMINATOR

STUDY

$$\frac{3}{7}+\frac{2}{7}=\frac{5}{7} \qquad \frac{5}{7}-\frac{3}{7}=\frac{5-3}{7}, \text{ or } \frac{2}{7}$$

$$\frac{3}{5}+\frac{1}{5}=\frac{4}{5} \qquad \frac{4}{5}-\frac{1}{5}=\frac{4-1}{5}, \text{ or } \frac{3}{5}$$

To subtract two fractional numbers with the same denominator, subtract the numerators and keep the denominator.

DO

Fill in blanks.

1. $\frac{5}{6}-\frac{4}{6}=\frac{5-4}{}$, or $\frac{1}{}$

2. $\frac{7}{9}-\frac{3}{9}=\frac{7-3}{}$, or $\frac{4}{}$

3. $\frac{5}{8}-\frac{2}{8}=\frac{5-}{8}$, or $\frac{}{8}$

4. $\frac{7}{11}-\frac{3}{11}=\frac{7-}{11}$, or $\frac{}{11}$

5. $\frac{4}{5}-\frac{2}{5}=\frac{-2}{5}$, or $\frac{}{5}$

6. $\frac{7}{10}-\frac{3}{10}=\frac{-3}{10}$, or $\frac{}{10}$

Subtract.

7. $\frac{4}{5}-\frac{3}{5}=$ _____

8. $\frac{7}{9}-\frac{2}{9}=$ _____

9. $\frac{7}{10}-\frac{4}{10}=$ _____

10. $\frac{7}{8}-\frac{2}{8}=$ _____

11. $\frac{6}{12}-\frac{1}{12}=$ _____

12. $\frac{5}{8}-\frac{2}{8}=$ _____

13. $\frac{6}{7}-\frac{3}{7}=$ _____

14. $\frac{4}{15}-\frac{2}{15}=$ _____

STUDY

Subtraction sentence and a related *addition* sentence

$7-2=5$ $\quad$ $5+2=7$

$\frac{6}{8}-\frac{1}{8}=\square$ $\quad$ $\square+\frac{1}{8}=\frac{6}{8}$

DO Write a related addition sentence for each subtraction sentence.

1. $8-6=2$ .....

2. $15-7=8$ .....

3. $\frac{9}{10}-\frac{2}{10}=\Delta$ .....

4. $\frac{3}{4}-\frac{2}{4}=\nabla$ .....

STUDY

To find $\frac{6}{8}-\frac{1}{8}=\square$, write $\square+\frac{1}{8}=\frac{6}{8}$.

Since $\frac{5}{8}+\frac{1}{8}=\frac{6}{8}$, then $\frac{6}{8}-\frac{1}{8}=\frac{5}{8}$.

DO Fill in blanks.

5. ..... $+\frac{3}{5}=\frac{4}{5}$

6. ..... $+\frac{3}{9}=\frac{8}{9}$

7. ..... $+\frac{5}{12}=\frac{1}{1}$

8. ..... $+\frac{3}{5}=\frac{4}{5}$ $\quad$ $\frac{4}{5}-\frac{3}{5}=$ .....

9. ..... $+\frac{2}{9}=\frac{7}{9}$ $\quad$ $\frac{7}{9}-\frac{2}{9}=$ .....

10. ..... $+\frac{6}{16}=\frac{13}{16}$ $\quad$ $\frac{13}{16}-\frac{6}{16}=$ .....

11. ..... $+\frac{6}{10}=\frac{9}{10}$ $\quad$ $\frac{9}{10}-\frac{6}{10}=$ .....

COMMON DENOMINATOR

STUDY

$\frac{3}{7}, \frac{1}{7}$ Each has the *same*, or *common*, *denominator*.

DO If there is a common denominator shown, write "yes." If not, write "no."

1. $\frac{1}{8}, \frac{3}{8}$ ..... $\frac{2}{3}, \frac{1}{2}$ ..... $\frac{3}{4}, \frac{4}{8}$ .....

STUDY

$$\frac{3}{10} + \frac{4}{10} = \frac{3+4}{10}, \text{ or } \frac{7}{10}$$

common denominator

DO

2. $\frac{3}{8}+\frac{4}{8}=$ ..... $\frac{5}{10}+\frac{2}{10}=$ ..... $\frac{1}{5}+\frac{1}{5}=$ .....

3. $\frac{5}{12}+\frac{6}{12}=$ ..... $\frac{2}{6}+\frac{3}{6}=$ ..... $\frac{3}{9}+\frac{4}{9}=$ .....

STUDY

$\frac{1}{4}+\frac{3}{8}$

not common denominator

$\frac{1}{4}$ renamed as $\frac{2}{8}$

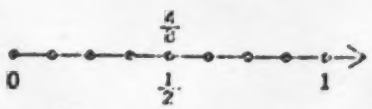
$\frac{1}{4}+\frac{3}{8}$

$\frac{2}{8}+\frac{3}{8}=\frac{5}{8}$

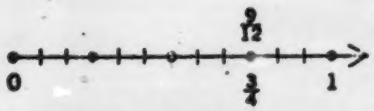
common denominator

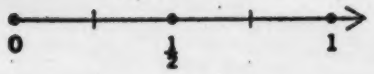
DO Use the number ray to find the common denominator. Then add.

4. $\frac{1}{2}+\frac{3}{8}=$ .....

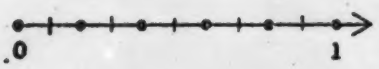


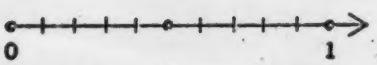
5. $\frac{1}{3}+\frac{3}{6}=$ .....

6. $\frac{2}{12}+\frac{3}{4}=$ ..... 

7. $\frac{1}{2}+\frac{1}{4}=$ ..... 

8. $\frac{3}{4}+\frac{1}{8}=$ .....

9. $\frac{1}{5}+\frac{1}{10}=$ ..... 

10. $\frac{1}{2}+\frac{2}{10}=$ ..... 

11. $\frac{2}{3}+\frac{1}{9}=$ .....

Add.

12. $\frac{1}{6}+\frac{4}{6}=$ ..... $\frac{1}{2}+\frac{2}{6}=$ ..... $\frac{1}{3}+\frac{2}{9}=$ .....

13. $\frac{3}{10}+\frac{6}{10}=$ ..... $\frac{1}{4}+\frac{2}{12}=$ ..... $\frac{5}{15}+\frac{6}{15}=$ .....

USING PROPERTIES OF ADDITION

STUDY

$(3+2)+4 = 3+(2+4)$ Associative Property
$= 3+(4+2)$ Commutative Property
$= (3+4)+2$ Associative Property
$= (4+3)+2$ Commutative Property

Addends can be placed in any order and grouped in any way.

$1\frac{3}{8}+5\frac{4}{8} = 1+\frac{3}{8}+5+\frac{4}{8}$
$= (1+5)+\left(\frac{3}{8}+\frac{4}{8}\right)$
$= 6+\frac{7}{8}$, or $6\frac{7}{8}$

The addends are ordered and grouped so that whole numbers are added and fractional numbers are added.

DO Add.

1. $6\frac{3}{10}+5\frac{4}{10}=$ ..... $5\frac{6}{8}+3\frac{1}{8}=$ ..... $9\frac{1}{5}+3\frac{3}{5}=$

STUDY

$1\frac{3}{8}$ First add fractional numbers.
$+5\frac{4}{8}$ Then add whole numbers.
$6\frac{7}{8}$

DO Add.

2.

$3\frac{3}{8}$	$2\frac{5}{10}$	$2\frac{1}{5}$	$7\frac{5}{12}$	$5\frac{6}{10}$
$+6\frac{4}{8}$	$+7\frac{2}{10}$	$+3\frac{1}{5}$	$+5\frac{6}{12}$	$+7\frac{3}{10}$

3.

$7\frac{3}{6}$	$5\frac{3}{9}$	$7\frac{1}{8}$	$5\frac{1}{8}$	$7\frac{1}{3}$
$+4\frac{2}{6}$	$+6\frac{4}{9}$	$+2\frac{2}{8}$	$+6\frac{4}{8}$	$+8\frac{1}{3}$

ASSOCIATIVE PROPERTY OF ADDITION 146

STUDY

We add two numbers at a time.

$(6+5)+4=11+4$, or 15 $\qquad 6+(5+4)=6+9$, or 15

$(6+5)+4=6+(5+4)$

$\left(\frac{2}{10}+\frac{3}{10}\right)+\frac{4}{10}=\frac{5}{10}+\frac{4}{10}$, or $\frac{9}{10}$ $\qquad \frac{2}{10}+\left(\frac{3}{10}+\frac{4}{10}\right)=\frac{2}{10}+\frac{7}{10}$, or $\frac{9}{10}$

$$\left(\frac{2}{10}+\frac{3}{10}\right)+\frac{4}{10}=\frac{2}{10}+\left(\frac{3}{10}+\frac{4}{10}\right)$$

Associative Property of Addition
The grouping of addends does not affect the sum.

DO Add.

1. $\left(\frac{1}{8}+\frac{2}{8}\right)+\frac{4}{8}=$ _____ $+\frac{4}{8}=$ _____

   $\frac{1}{8}+\left(\frac{2}{8}+\frac{4}{8}\right)=\frac{1}{8}+$ _____ $=$ _____

2. $\frac{3}{10}+\left(\frac{4}{10}+\frac{2}{10}\right)=$ _____ $+$ _____ $=$ _____

   $\left(\frac{3}{10}+\frac{4}{10}\right)+\frac{2}{10}=$ _____ $+$ _____ $=$ _____

3. $\left(\frac{8}{15}+\frac{2}{15}\right)+\frac{1}{15}=$ _____ $+$ _____ $=$ _____

   $\frac{8}{15}+\left(\frac{2}{15}+\frac{1}{15}\right)=$ _____ $+$ _____ $=$ _____

4. $\frac{6}{24}+\left(\frac{3}{24}+\frac{8}{24}\right)=$ _____ $+$ _____ $=$ _____

   $\left(\frac{6}{24}+\frac{3}{24}\right)+\frac{8}{24}=$ _____ $+$ _____ $=$ _____

Fill in blanks.

5. $\left(\frac{3}{4}+\frac{1}{8}\right)+\frac{2}{3}=$ _____ $+\left(\frac{1}{8}+\frac{2}{3}\right)$ $\qquad \left(\frac{7}{4}+\frac{3}{2}\right)+$ _____ $=\frac{7}{4}+\left(\frac{3}{2}+\frac{3}{8}\right)$

ADDITION: VERTICAL FORM

STUDY

Horizontal Form	*Vertical Form*
$\frac{3}{8}+\frac{4}{8}=\frac{3+4}{8}$, or $\frac{7}{8}$	$\begin{array}{r} \frac{3}{8} \\ +\frac{4}{8} \\ \hline \frac{7}{8} \end{array}$

DO Add.

1. $\begin{array}{r} \frac{7}{10} \\ +\frac{2}{10} \\ \hline \end{array}$ $\begin{array}{r} \frac{3}{6} \\ +\frac{2}{6} \\ \hline \end{array}$ $\begin{array}{r} \frac{5}{16} \\ +\frac{8}{16} \\ \hline \end{array}$ $\begin{array}{r} \frac{5}{8} \\ +\frac{2}{8} \\ \hline \end{array}$

2. $\begin{array}{r} \frac{3}{5} \\ +\frac{1}{5} \\ \hline \end{array}$ $\begin{array}{r} \frac{3}{9} \\ +\frac{4}{9} \\ \hline \end{array}$ $\begin{array}{r} \frac{5}{10} \\ +\frac{2}{10} \\ \hline \end{array}$ $\begin{array}{r} \frac{8}{20} \\ +\frac{3}{20} \\ \hline \end{array}$

3. $\begin{array}{r} \frac{8}{20} \\ +\frac{9}{20} \\ \hline \end{array}$ $\begin{array}{r} \frac{9}{24} \\ +\frac{8}{24} \\ \hline \end{array}$ $\begin{array}{r} \frac{12}{32} \\ +\frac{19}{32} \\ \hline \end{array}$ $\begin{array}{r} \frac{20}{40} \\ +\frac{13}{40} \\ \hline \end{array}$

Which are true and which are false?

4. $\frac{1}{5}+\frac{1}{5}=\frac{1+1}{5}$ .....

5. $\frac{3}{8}+\frac{4}{8}=\frac{7}{16}$ .....

6. $\frac{1}{3}+\frac{1}{3}=\frac{1+1}{3+3}$ .....

7. $\frac{5}{10}+\frac{4}{10}=\frac{9}{10}$ .....

APPENDIX E

arbor public schools

2555 south state road post office box 1188 ann arbor, michigan 48106

Jean
Kit is interested in the Math Project
Bob

February 15, 1979

Mr. Robert Million
Washington High School
4747 W. Washington
South Bend, Indiana 46614

Dear Mr. Million:

Recently I attended the Annual Conference of the National Association of Secondary School Principals. The NASSP 1978-79 Exemplary Programs File listed your school as having a Learning/Styles/Cognitive Mapping Plan.

Please send me information regarding this program. Thank you.

Very truly yours,

Richard B. Stock

Richard B. Stock
Director of Secondary Education

RBS/jm

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